



IMPERIAL INSTITUTE
OF
AGRICULTURAL RESEARCH, PUSA.

EXPERIMENT STATION RECORD.

VOL. 48.

JANUARY, 1923.

No. 1.

The recent convention of the Association of Land-Grant Colleges presented a number of very interesting discussions which centered around the station worker and his work. These related, for example, to his training, for this is increasingly recognized as an indispensable factor in productive investigation, although there is not full unanimity of opinion as to the character of that training. The discussion took account also of the worker's environment, the demands made upon him, his relationship and that of the station as a whole to other activities of the college and to farm groups. In reference to the station work, the limitations of what a single station can attempt to accomplish, the national or regional character of a large percentage of the problems, and the great importance of some form of cooperation or correlation in the attack upon these problems were brought out anew.

Opinion on some of these points was not unanimous, but this fact added interest and value to the discussion. Such a divergence of view is entirely natural, for some of the questions involved are broad ones and conditions in different sections differ widely; but the presentation of these matters from varying points of view was exceedingly helpful, and only by such means can they be clarified and general sentiment harmonized.

There was a quite widespread opinion that the colleges of agriculture must to a considerable extent train their own workers, and that in this connection an obligation rests upon the experiment stations. Many of the leading specialists at these colleges who are engaged in advanced research are found in the ranks of the station, and the problems they are engaged upon were felt to afford exceptional opportunity for graduate students to come in contact with original inquiry in agriculture. This is not a new idea, and while it has much to commend it in the direction of insuring an agricultural outlook and the early establishment of such contacts, it is not wholly in line with the securing of breadth and thoroughness in fundamental training. The view seemed to be gaining ground a few years ago that what was especially needed in the development of strong, resourceful investigators was broad and severe training in the fundamentals of science,

with avoidance of too early specialization tending to give a restricted view of the subject. The extent to which graduate instruction at the agricultural colleges has developed in the past few years may in a measure be responsible for the present view.

The sentiment of many administrative officers was well expressed by the statement of one speaker who maintained that "the agricultural experiment station in intimate association with the college teaching in the graduate school furnishes an exceptional opportunity for developing a high grade of graduate work in connection with the college of agriculture." In anticipation of the possible suggestion that this might interfere with the time of the investigator he argued that "it is easily possible for the investigator to utilize the projects of the experiment station in the instruction of graduate students in such a way that the student may actually contribute to the success of the investigations and thus become a real asset to the experiment station." There was other testimony in the same direction, indicating a quite widespread sympathy with such a view and practice. A number of directors stated that research scholarships and fellowships were maintained from experiment station funds, one stating that in this way the station "really acquires the full time of a graduate student at work on an experiment station project."

The relation of the station to the graduate work of the college of agriculture was treated in a formal paper by Dr. E. W. Allen, who called attention to the prevalence of associating graduate students with the work of the station, and the possible effect it might have on adequate provision for the station investigation and on the student himself. The general contention of the speaker was that the experiment station at this stage needs strong, seasoned investigators, that research is its primary function, and that for it instruction should be incidental and secondary, determined in large measure by the advantage to the station. The latter ought so far as possible to be sufficient unto itself, competent to do its own work, and the progress of its investigation should not be contingent on the registration or preferences of graduate students.

On the other hand, the advantages to the student of association with a station worker engaged in advanced investigation was fully recognized, as well as the possibility at times of using such help to advantage in connection with the station projects. Many of the station specialists are also on the instruction force of the college, and are thus available for certain types of teaching. It is only an interpretation of duties, therefore, which assigns to the station activity such graduate instruction and supervision of the thesis as these teacher-investigators may give. Probably confusion might be avoided by clear recognition of the two functions. In some institutions, however, station workers have been allotted a certain number

of research fellows in lieu of assistants, and in notable instances the investigation of a station department consists almost wholly of students working for degrees. To make the progress and course of station projects contingent on the supply and preferences of such help was held to subordinate the station's activities in a manner to weaken them, and to prevent the development of a permanent force of the type needed.

Stress has frequently been laid on the economy of using graduate students and the increased amount of work which could thereby be accomplished in the station. While this is doubtless true to some extent, it may likewise be a makeshift, and there is danger that it may make the progress of the projects irregular and disconnected instead of a well ordered, logical course of advancement. There is danger also that the student may be too largely employed on routine matters, and because of the investigator's interest in the problem may receive an undue amount of suggestion and interpretation. Evidently it will not do to exploit him by making him a tool in the hands of the investigator.

The employment of such help as an economy measure is evidence of the need for a larger research force and for the funds for providing such a force. In that sense it may be regarded as a response to inadequate man power on the part of the station, as well as to a desire on the part of graduate students to participate in the station's investigation. There is a difference between the research activity of a station department and that of a college professor who relies mainly on his advanced pupils,—between sustained investigation associated with established projects of a public institution and that incidental to teaching the student in the ways of research. The latter is in a sense a personal product of a department without responsibility to the public for its research output, while with the station research is the primary objective, coincident to nothing else as far as its resources permit.

These things were cited to suggest caution and to keep clear the essential functions. Without doubt the station should be free to utilize the services of students studying for advanced degrees as far as is to its advantage, and within limits to open its laboratories to such as are capable of using them profitably; but care needs to be exercised on the one hand not to weaken the station or the development of its staff, and on the other to regard the best interests of the student.

The attitude toward this matter and the extent to which the practice is being followed was developed in a paper by Dean E. C. Johnson, who presented the replies to a questionnaire he had sent to all the stations. These replies showed that at least half the stations are now making use of graduate students in their work,

the number being as high as fifteen in some stations, and that most of the institutions regarded the practice as satisfactory. Twenty-two used for this purpose funds which were assigned to the stations for research, the amount ranging from a few hundred dollars up to \$15,000 in a year. A number of others stated, however, that no scholarships were ever provided out of the station finances.

The general consensus of opinion was that the number of such students taken on by a station should be quite limited. But, as one dean and director remarked, "the demand for graduate instruction is such that an investigator capable of handling graduate students soon has more on his hands than he can attend to and consequently the investigational work must suffer if the graduate students are to be adequately cared for." This is a repetition of the danger experienced in the past with respect to undergraduate teaching. It is exactly what happened after the war, with the result that there was a slump in research, almost a cessation in some station departments. It is this danger which suggests caution. A limited number of research fellows may often be helpful, but that number is confessedly small. It varies, furthermore, with the investigator and the circumstances. Who is to determine it? Apparently station men are not always free to do so.

The training of research workers was also considered by Dean F. B. Munford in a thoughtful paper entitled *The Problems of Research in a College of Agriculture*. He advocated close relations between the station and the college, particularly through carefully regulated teaching of advanced students by investigators, and stressed the development of the scientific spirit throughout the college. He declared that "the ideal relation of the investigator to college teaching is one in which the researcher has charge of a group of graduate students. Such a relation can not fail to inspire both the investigator and the student."

Dean Munford noted as one of the primary functions of administrative officers the recognition and emphasis of true values, in productive scholarships as well as in the more spectacular achievements of the college activity. The great asset of a station was held not to be huge buildings or expensive equipment but its men, and it was made clear that size bears no significant relation to the quality of the research.

The importance of careful consideration of the environment of the research worker and of the maintenance of proper contacts with agriculture was set forth in a paper by Director S. B. Haskell. In this paper he emphasizes the essential objectives of research in agriculture, and the spirit of service. The problem as he put it is lest "our scientific men, research workers in agriculture immured within an academic institution, lose touch with their clientele, forget

the necessity of service to agriculture, and tend toward the pursuit of knowledge for itself alone. Other men working in the field, become steeped in the atmosphere of practice, and cease to bring to agriculture the services of real science. Somehow, somewhere, must we bring the former graduate into contact with the vital problems of agriculture, and the latter into renewed contact with the standards of the pure sciences, in order that we may continue to use these sciences as efficient tools in the pursuit of agricultural research—research for the public benefit through the medium of the agricultural industry."

In further considering this subject Dean Cooper of Kentucky agreed that there is a tendency in stations located in connection with large universities toward conditions of living and environment far removed from the conditions on the farm, but thought it a safe generalization that the majority of workers are dominated by the motive of service to agriculture. He enumerated as influences favorable to research in agriculture a continuing farm experience that will enable the worker to comprehend problems in his field, a reasonable opportunity to follow out a line of investigation, freedom to a large degree from the calls of other work, and contact with other scientific workers.

Since the practical bearings which a project is given come through a practical understanding on the part of the worker, Dean Cooper urged that "the experiment station must provide a method by which the young investigator may make and maintain these contacts." Others urged the importance of station workers keeping in touch with practical affairs, and with leading farmers through attendance on meetings from time to time. Some have maintained that workers in that field should have farm experience, and should be thoroughly cognizant with the condition of practical agricultural affairs.

On the other hand, Dr. A. C. True pointed out that the desirability of such farm experience and contacts depended upon the kind of station work which was being done, maintaining that in the more advanced ranges of inquiry these things were far less essential. Others expressed the advantage of protecting such investigators and freeing them from the obligations from the outside which come as interruptions in their studies. While the original investigator can not withdraw himself from the world and the public he is ultimately to serve, it will be recognized that he is relatively scarce and is far outnumbered by workers who hold close to the farm problems and the farming people.

The perennial interest of the association in the subject of cooperation was reflected in the program of the Washington meeting. A broad view of the subject was presented in a paper by Dr. E. D. Ball, Director of Scientific Work of this Department. He argued for a

comprehensive mobilization of the resources of the country along broad lines for the promotion of research for national development. While the great contributions to world progress in the generations past have been made by a relatively few men, it was recognized that "there are literally thousands who can accumulate evidence, work out details, expand ideas, and trace relationships where there is one exceptional individual who is capable of freeing himself from the shackles of the accepted, who is willing to leave the beaten path and actually explore, and who holds all information as relative and subject to investigation, who can critically analyze and evaluate factors and interpret results." Furthermore, an individual may be gifted in one line and deficient in another, these deficiencies being offset through cooperation.

Among the fundamentals essential to a more comprehensive attack on scientific problems Dr. Ball enumerated the encouragement of graduate training, provision for the prompt publication of such aids to scientific work as translations, bibliographies, indexes and summaries, recognition of the fact that knowledge is universal, transcending State and even National boundaries, and the development of constructive leadership. Contending that relatively few of the important projects in agriculture are fundamentally local, he maintained that the amount of research carried on in the different localities could be greatly increased at a relatively small increase in the total cost of maintenance through the inauguration of a broad general program.

The various types of cooperative effort were described as including simple arrangements involving a single bureau of the Government and a single department of a station; a modification of this in which the field of work is divided, one party taking entire charge of one line of investigation and the other of another; more ambitious programs involving a number of agencies; and a plan rare in this country in which the exceptional investigator or investigation is sought out and funds contributed for the joint support. In addition, another form which has been quite prominent is the development of pest eradication programs in which complete cooperation is required. The plans set forth in Dr. Ball's paper were quite specific, and outlined the essentials to success in the various types of cooperative undertakings.

In connection with another paper, Dean F. B. Mumford presented the idea of the experiment stations as "in a sense units of a single vast organization for scientific research," and declared that "we shall not have fulfilled our implied obligation to the nation if we continue to emphasize our individualistic status." It is not necessary, he maintained, for every station to attempt to solve every problem pertaining

to its agriculture, but he thought the resources of the stations should be conserved by dividing up large problems so that parts might be parceled out, enabling the single station to devote itself to a relatively restricted field. Many will admit the force of his contention that "ten stations each working on a distinct phase of a big problem will accomplish immeasurably more than ten stations all working on all phases of the same problem."

The desirability of close cooperation within an institution as a preliminary to outside contacts was emphasized by Dean H. W. Mumford of Illinois, who also referred to the great present-day need of cooperation between the various State stations. As regards State and Federal cooperation, he expressed the view that "in the long run the largest and best development along the lines of agricultural betterment will come from the promotion of the idea of the State's responsibility for agricultural research, combined with the encouragement of Federal and State cooperation in agricultural research that leaves both the State and Federal authorities independent so far as financial and administrative considerations are concerned."

The joint committee on projects and correlation of research reaffirmed its belief that the association should favor a closer correlation of research between the States and the Federal Government. The committee felt that in general the Federal Government has a primary obligation to undertake the study of problems of international, national or regional importance, that the States should concern themselves with their respective local needs, and that the zone of effort between these extremes should be constantly a subject of consideration as to whether the objects of agricultural science could not be best subserved by joint action of the Federal and State forces. Such problems often require a consideration of fundamental studies that extend far beyond the resources of most individual stations.

Now that a director of scientific work has been established in the Department of Agriculture, the committee believed that specific attention should be called to the great desirability of station directors consulting with the Federal authorities in inaugurating research of such a character that the higher interests of science and efficiency may be served. A reciprocal attitude on the part of the Federal department it was thought would greatly strengthen the position of agricultural science in the national economy.

The sentiments expressed in relation to cooperation evidenced a feeling that many large matters need to be looked at from the standpoint of the problem and its most efficient solution, rather than from that of geographic locality and institutional domain; and that with the present provision for coordination the way is opening for attacking some of these large questions from a national or regional stand-

point instead of an isolated independent one. The expressions voiced a recognized unity of interests and the growth of the cooperative idea.

The discussions cited and those referred to in a previous article indicate the studious attention which is being given to research and the development of conditions favorable to it. How to make the utmost of the research forces and the facilities of the experiment stations and similar institutions is manifestly of the utmost importance when the pressure is so great. What individual stations shall attempt to do independently and how their efforts may effectively be joined with one another and with other groups is not a new question, but is gaining in clarity with study and experience. The interrelationship and the interdependence of institutions is becoming more evident as the nature of investigation progresses and the limitations of individuals and of institutions is felt. Hence the effort is persistent to round out a national system of the greatest benefit to agricultural science and to farming practice.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

The determination of globulins in blood serum. R. R. HENLEY (*Jour. Biol. Chem.*, 52 (1922), No. 2, pp. 367-375) — A comparison is reported of the relative merits of the Cullen and Van Slyke method of determining globulins in blood serum (*E. S. R.*, 43 p. 205) and of two methods for this determination which have been in use for a number of years at the Bureau of Animal Industry, U. S. D. A.

The first of these methods consists essentially in determining the total nitrogen in the serum and in the filtrate after precipitation of the globulins with saturated magnesium sulphate. The difference between the two results represents the globulin nitrogen, and the factor 6.3 is used to convert this to globulin, the results being expressed in grams of globulin per 100 cc. of serum.

In the second method, which is considerably longer than the first, the globulins are determined gravimetrically after two successive precipitations with saturated ammonium sulphate, the precipitate being dissolved each time in physiological salt solution, and a final precipitation made by heat with the addition of 1 or 2 drops of a 10 per cent solution of acetic acid.

The globulins present in three different lots of horse serum were determined by each of the three methods, all determinations being made in duplicate. The average results obtained for the three serums tested in the order of the first and second methods described above and the Cullen-Van Slyke method are, respectively, 5.59, 5.52, and 5.32, 5.55, 5.48, and 5.01 and 3.96, 4.00 and 4.14 gm per 100 cc. Duplicate determinations agreed slightly more closely when made by the Cullen-Van Slyke method than by the other two, but this method is considered to be more complicated and to require more care than the other methods. The first method is recommended as being the simplest of the three and requiring less attention and time than the others.

The separation of the hexone bases from a protein hydrolysate by electrolysis. G. L. FOSTER and C. L. A. SCHMIDT (*Soc. Expt. Biol. and Med. Proc.*, 19 (1922), No. 7, pp. 348-351).—A brief report is given of a study of the applicability to the isolation of basic amino acids of a method previously described by Ikeda and Suzuki, depending upon the electrolytic separation of the amino acids under the action of an electric current in a 3-compartment cell into three fractions consisting of (1) those which are predominantly acid, including aspartic and glutamic acids which migrate to the anode; (2) the basic amino acids, including arginin, histidin, and lysin which migrate to the cathode; and (3) the remaining amino acids which are neither acid nor basic and remain in the center compartment.

In the experimental work reported the protein hydrolysate was placed in the center compartment of the cell and distilled water in the compartments containing the electrodes, which consisted of thin sheets of carbon. The liquid in the center compartment was kept at the desired H-ion concentration by the addition of small quantities of barium hydroxid at frequent intervals, and the

reaction of the cathode liquid was kept approximately neutral by the occasional addition of sulphuric acid. The temperature of the solutions during electrolysis was kept below 35° C. by circulating a stream of water through a test tube in the center compartment and by continuous agitation of the solution.

A table is given of the distribution of nitrogen in a gelatin hydrolysate before and after electrolysis at pH values of 7.5 and 5.5. At the latter concentration the three basic amino acids were present in the cathode solution in approximately the same proportions as in the original hydrolysate, while in the more alkaline solution histidin was not carried over into the cathode compartment. The method is considered of general applicability for the separation of the basic amino acids.

Note on the liver oil of the tope (*Galeus galeus*), A. C. CHAPMAN (*Analyst*, 47 (1922), No. 554, pp. 203, 204) —An analysis of the oil obtained from the liver of the tope (*G. galeus*) is reported with the following results: Specific gravity (15°/15° C.) 0.9249, iodine value (Wijs) 152.2, saponification value 185.1, unsaponifiable matters 1.14 per cent, and refractive index at 15° C. 1.4803 per cent. Attention is called to the fact that these constants are very similar to those given by cod liver oil, and that the oil is sometimes employed for medicinal purposes.

The preparation of clear beef agar, F. W. MARSH (*Science*, 56 (1922), No. 1448, pp. 367, 368) —A method of preparing clear beef agar with an H-ion concentration of from pH 6.6 to 7 is described as follows:

Three gm. of Liebig's extract, 10 gm. of peptone, 5 gm. of sodium chlorid, and 10 gm. of agar are dissolved in 1 liter of distilled water by flowing steam, and the mixture adjusted while hot to a pH of about 8.2 with an approximately normal solution of sodium hydroxid. After cooling to 45 or 50° C. the beaten whites of two fresh eggs or 5 gm. of egg albumin powder beaten up in 50 cc. of distilled water are added. After mixing thoroughly by pouring from one container into another, the liquid is autoclaved for 15 minutes at 15 lbs. pressure, filtered through paper or through an absorbent cotton by suction, and the filtrate adjusted to the desired pH with an approximately normal solution of hydrochloric acid. It is then autoclaved for 5 minutes at 15 lbs. pressure, filtered through paper, tubed, and sterilized for 20 minutes at 15 lbs. pressure.

A modification of the Clark hydrogen electrode vessel to permit accurate temperature control, G. E. CULLEN (*Jour. Biol. Chem.*, 52 (1922), No. 2, pp. 521-524, fig. 1).—To obtain accurate temperature control in the Clark hydrogen electrode vessel, it is suggested that an extra opening be made in the apparatus for the introduction of a short calibrated thermometer, the bulb of which should be of such dimensions as not to obstruct the flow of the solution during the rocking of the electrode. A diagram of the modified apparatus and specifications for the opening and the thermometer are included.

A comparison of colorimetric and electrometric determinations of H-ion concentrations in solutions containing carbon dioxide, G. E. CULLEN and A. B. HASTINGS (*Jour. Biol. Chem.*, 52 (1922), No. 2, pp. 517-520).—A comparison under carefully controlled conditions of the colorimetric and the electrometric methods of determining the H-ion concentration of solutions containing carbon dioxide is reported. It is concluded that these methods agree when carried out with rigorous precautions to prevent loss of CO₂.

A micro-Kjeldahl method of determining nitrogen, A. R. LING and W. J. PRICE (*Jour. Soc. Chem. Indus.*, 41 (1922), No. 10, pp. 149T-151T, fig. 1).—The method described, which is applicable to the determination of nitrogen in substances such as starch and other carbohydrates which contain only a trace

of protein, is in principle similar to the micro method involving direct messlerization described by Folin and Denis (E. S. R., 36, p. 316). In place of using phosphoric acid in the digestion mixture, as in the technique of Folin and Denis, two drops of 2.5 per cent platinum tetrachlorid is added.

The determination of ammoniacal nitrogen in nitrogenous matter, particularly in proteins and their decomposition products, J. FROIDEVAUX (*Ann. Chim. Analyt.*, 2. ser., 4 (1922), No. 7, pp. 199-201, fig. 1).—The apparatus and technique previously noted (E. S. R., 46, p. 12) have been applied to the determination of ammonia nitrogen in the presence of amino nitrogen by continuing the distillation with sodium hydroxid in the cold for a period of 30 hours and determining the ammonia liberated at the end of 2-hour periods. When the milligrams of nitrogen liberated are plotted against the time in hours, the resulting curve takes the form of a straight line with a steep slope to about 8 hours and another straight line with lower slope from about 12 hours on. The first straight line is considered to represent the ammonia nitrogen and the last the amino nitrogen, while the connecting curve represents a mixture of the two. By extending the straight lines until they meet the ordinate is considered to represent the content in ammonia nitrogen.

A colorimetric method for the determination of small amounts of magnesium, A. P. BRIGGS (*Jour. Biol. Chem.*, 52 (1922), No. 2, pp. 349-355).—The technique of Bell and Doisy for determining phosphorus colorimetrically by the reduction of phosphomolybdic acid by hydroquinone in the presence of excess ammonium molybdate (E. S. R., 44, p. 613) has been applied to the determination of the phosphorus content of precipitated $MgNH_4PO_4$. The method, while applicable to any substance from which $MgNH_4PO_4$ may be precipitated, has thus far been used chiefly for the determination of magnesium in conjunction with calcium and other inorganic elements in the trichloroacetic acid filtrates from citrated blood plasma. The calcium is removed from these filtrates by precipitation with potassium oxalate after the addition of sufficient potassium acetate to bring the acidity of the filtrate to pH 4 or 5.

The technique of the method is described, and the results are reported of its application in the recovery of known amounts of magnesium and in magnesium determinations on urine and blood plasma. The data are thought to indicate that a total error of less than 4 per cent may be expected when working with such amounts of magnesium as are found in 3 cc. of blood plasma.

The determination of magnesium in blood, plasma, and serum, W. DENIS (*Jour. Biol. Chem.*, 52 (1922), No. 2, pp. 411-415).—The method described, which is similar in principal to that of Briggs noted above, is said to be applicable both to the blood filtrate obtained from the determination of calcium by the method of Lyman (E. S. R., 37, p. 207) and to the supernatant liquid obtained in the determination of calcium in the serum by the method of Clark (E. S. R., 47, p. 14). The technique in both cases is described, and the results are reported of the recovery of magnesium added to serum, plasma, and blood. These results indicate that the method can be relied upon to give results within an error of 5 per cent.

A new method for the determination of small quantities of furfural by colorimetry, P. FLEURY and G. POIROT (*Jour. Pharm. et Chim.*, 7. ser., 26 (1922), No. 3, pp. 87-96).—The method described depends upon the fact that furfural unites with orcinol to form a grayish-blue precipitate which dissolves in certain solvents, preferably acetic acid, with the formation of a deep blue color. By comparison in a colorimeter with standards containing known amounts of furfural the amount of furfural in an unknown solution can be determined.

Note on the examination of foods for the presence of sulphites, A. C. CHAPMAN (*Analyst*, 47 (1922), No. 554, pp. 204, 205).—Attention is called to the fact that foods containing sulphur in organic combination will occasionally give positive results in the usual test for sulphites. To avoid the possibility of error in making this test, it is suggested that hydrogen peroxid be used in place of bromin as an oxidizing agent in cases in which a very small amount of sulphuric acid is obtained when distilling with bromin water.

The testing of foodstuffs for vitamins, J. C. DRUMMOND and A. F. WATSON (*Analyst*, 47 (1922), No. 555, pp. 235–244, figs. 4).—In this paper, which was presented before the Society of Public Analysts, England, brief descriptions are given of established technique for testing foodstuffs for vitamins A, B, and C, and examples are cited of recent results obtained in vitamin studies which have a bearing on food in its relation to public health.

A physiological test for the activity of vitamin preparations, A. SEIDELL (*Pub. Health Rpts.* [U. S.], 37 (1922), No. 25, pp. 1519–1523).—A detailed description is given of the technique employed at the Hygienic Laboratory of the U. S. Public Health Service in testing for the activity of vitamin preparations.

Pigeons are fed polished rice supplemented on alternate days by a dose of activated solid prepared as previously described (*E. S. R.*, 47, p. 408) and administered in gelatin capsules in amounts just sufficient to prevent an appreciable loss in weight. Solutions of the material to be tested are taken up in fuller's earth and substituted for the activated earth, and the loss or gain in weight of the pigeons is observed. It is stated that positive results can usually be obtained within two weeks by this method and that samples devoid of antineuritic vitamin can be identified very promptly. It is emphasized that the principal difficulty in making the test is in the selection of the dosage, and that accurate results require a repetition of the test with repeated adjustment of dosage. At the completion of a test the administration of the minimum protective dose of activated solid is resumed and the pigeons are ready for another test within 10 days.

The principal use that has been made of this technique in the author's laboratory has been in controlling the fractionation steps in attempts to isolate the antineuritic vitamin from brewer's yeast, but the method is considered to be equally applicable to the determination of the antineuritic vitamin content of food preparations in general.

Glacial acetic acid as a solvent for the antineuritic substance, water-soluble B, V. E. LEVINE, E. V. MCCOLLUM, and N. SIMMONDS (*Jour. Biol. Chem.*, 53 (1922), No. 1, pp. 7–11).—The authors have found glacial acetic acid to be an excellent solvent for vitamin B. Its application in the extraction of vitamin B from raw navy beans is outlined, and various advantages in its use as compared with other solvents are discussed.

The detection of hypochlorites and chloramins in milk and cream, P. RUPP (*U. S. Dept. Agr. Bul.* 1114 (1922), pp. 5).—It is reported that hypochlorites and chloramins can be detected in milk and cream in as high a dilution as 1 part of chlorin in 50,000 parts of milk by the use of potassium iodid and hydrochloric acid. The test is as follows:

To 5 cc. of the milk or cream in a medium sized test tube add 1.5 cc. of freshly prepared 7 per cent potassium iodid solution, mix thoroughly by shaking, and observe the color. If the sample contains available chlorin to the extent of 1:1,000 the color becomes yellowish brown, 1:2,500 deep yellow, and 1:5,000 a pale yellow which fades rapidly. In the absence of positive results add 4 cc. of hydrochloric acid in 1:2 solution, mix thoroughly, place the tube in the water bath at 85° C. and allow to remain 10 minutes, and

then cool the tube rapidly in cold water. At this point both curd and whey have a yellow color in the presence of chlorin, the color varying in intensity with the amount present. On adding from 0.5 to 1 cc. of 1 per cent starch solution, the color of the whey changes to a bluish or reddish purple.

It is stated that milk kept in the ice box for from 24 to 48 hours still gives the reaction, that milk kept at room temperature for 24 hours gives a slightly less marked reaction than if kept cold, and that milk pasteurized at 145° F. for 30 minutes after the addition of hypochlorites reacts the same as raw milk.

The acetic index for the detection of the adulteration of butter, G. FASSETTI (*Gior. Chim. Indus. ed Appl.*, 4 (1922), No. 8, pp. 352-355).—The author proposes as a test for the adulteration of butter with oleomargarin or cocoa butter the critical temperature of solution of the butter in 98.5 per cent acetic acid. A correction is made for the acidity of the butter by adding to the temperature of the solution the number of cubic centimeters of N/20 base required to neutralize 2 gm. of the fat, using phenolphthalein as indicator. The acetic index as thus obtained for a number of samples examined varied from 64 to 68 with fresh butter, from 39 to 34 with cocoa butter, and from 113.5 to 118 with margarin. The addition of 5 per cent of cocoa butter to fresh butter lowered the index by from 3 to 4°, and of the same amount of margarin raised the number by from 4 to 5°.

The native sugar industry of Szechwan Province, western China, H. K. RICHARDSON (*Chem. and Metall. Engin.*, 27 (1922), No. 3, pp. 105-108, figs. 9).—A brief description is given of sugar cane cultivation in Szechwan Province, China, and of the methods used in producing and refining the raw sugar.

Sun drying v. dehydration.—A preliminary report, P. F. NICHOLS (*Calif. Dept. Agr. Mo. Bul.*, 10 (1921), No. 5-6, pp. 191-199).—This is a comparison of the relative merits of sun drying and dehydration with particular reference to California fruits, the points considered being yield, quality of the product, initial investment, and cost of production.

It is shown that a greater yield can be obtained in artificial dehydrated than sun-dried fruit, partly on account of the fact that much riper fruit can be used for dehydration than for sun drying, and partly because in the former process losses from rain damage do not occur. The quality of the dehydrated products is generally considered superior, since these are lighter in color, have more of the fresh flavor, require less sulphur when sulphur is used, and may be of larger size, due to their greater degree of ripeness.

The investment required for dehydrators is in general larger than that for dry yards, estimated on the basis of the amount of fruit dried per season. The cost of drying raisins and prunes is greater in dehydration than in sun drying, but it is considered that the greater cost of manufacture of dehydrated products may be more than offset by the higher prices they may command when their qualities are more widely known.

By-products from citrus fruits, E. M. CHACE (*U. S. Dept. Agr., Dept. Circ.* 232 (1922), pp. 13, fig. 1).—This circular contains directions for the manufacture of bottled grapefruit juice, orange vinegar by the roller and the rapid generator processes, and citric acid from lemon or lime juice, together with recipes suitable for use on a small or large scale for candied orange and grapefruit peel, citrus fruit marmalades and jellies, and orange butter.

By-products from crushing peanuts, J. B. REED (*U. S. Dept. Agr. Bul.* 1096 (1922), pp. 12, fig. 1).—This publication contains descriptions of the hydraulic and expeller processes for making peanut oil and of the various feeding stuffs prepared from the residual cake; proximate analyses of pure peanut meal and cake, peanut hulls, germs, meats, and skins, and high and low grade peanut cake and meal; and formulas and tables based upon these analyses for cal-

culating the percentage of hulls in the feeding stuffs from either the percentage of protein or crude fiber.

The definitions adopted by the Association of Feed Control Officials of the United States for peanut products are as follows: "Peanut oil cake is the residue after extraction of part of the oil by pressure or solvents from peanut kernels. Peanut oil meal is ground peanut oil cake. Unhulled peanut oil feed is the ground residue obtained after extraction of part of the oil from whole peanuts." According to these definitions peanut oil meal should contain no hulls other than those impossible to remove in the ordinary milling process. The data reported on the analyses of pure peanut meals obtained by crushing shelled peanuts and on pure peanut hulls from hand-shelled peanuts give an average fiber content of the pure meal as 4.7 per cent and of the hulls as 67.5 per cent. Corresponding figures for protein, based on a moisture content of about 7 per cent, are, respectively, 51.7 and 5.4 per cent. Using these average values the formulas developed for calculating the hulls (X) in a peanut meal feed from the fiber content and the protein content are, respectively,

$$X = \frac{\text{fiber} - 4.7}{0.628}, \text{ and } X = \frac{51.7 - \text{protein}}{0.463}.$$

For facilitating control work a table has been calculated from these formulas for all possible values between the minimum and maximum protein and fiber values reported. Protein and fiber curves are also given from which the percentage of hulls can be determined at a glance.

Some experiments with a boric-acid canning powder, R. B. EDMONDSON, C. THOM, and L. T. GILTNER (*U. S. Dept. Agr., Dept. Cuc* 237 (1922), pp. 12).—A boric-acid canning powder widely used in many sections of the country was subjected to critical examination, both in test-tube experiments in which its antiseptic action on a large number of bacteria and yeasts was tested and in practical canning experiments in which many fruits and vegetables were canned with the addition of the powder according to directions accompanying it. As a check on the efficiency of this method of canning, similar materials were canned in the same way without the powder and also by the one period cold pack method. A number of jars in each series were artificially inoculated with bacteria at the time of canning.

In the test-tube experiments the powder exerted an antiseptic action on certain molds and aerobic organisms, but on none of the groups responsible for spoilage in properly processed jars or cans. In the practical canning experiments, material packed without the powder kept as well as that packed with it, and in the case of the more or less neutral vegetables the method recommended proved insufficient to preserve the materials or to prevent the production of toxin in them by *Bacillus botulinus*.

METEOROLOGY.

Climatic changes, E. HUNTINGTON and S. S. VISHER (*New Haven: Yale Univ. Press, 1922, pp. XVI+329, figs. 13*).—This is an exposition of the nature and causes of climatic changes, based largely upon studies and conclusions by the senior author, which have been previously noted in part from various sources (E. S. R., 30, p. 416; 31, p. 509; 33, p. 19; 35, p. 14; 39, p. 719; 44, p. 414).

The general conclusion is that there have been important pulsatory changes of climate during historic times, and that these are magnifications of the little climatic changes which now take place in sun-spot cycles. The discussion deals

particularly with four main hypotheses, "(1) that the earth's present climatic variations are correlated with changes in the solar atmosphere, . . . (2) that variations in the solar atmosphere influence the earth's climate chiefly by causing variations not only in temperature but also in atmospheric pressure and thus in storminess, wind, and rainfall, . . . (3) that many climatic conditions are due to purely terrestrial causes, such as the form and altitude of the lands, the degree to which the continents are united, the movement of ocean currents, the activity of volcanoes, and the composition of the atmosphere and the ocean, . . . (4) that if the climatic conditions which now prevail at times of solar activity were magnified sufficiently and if they occurred in conjunction with certain important terrestrial conditions of which there is good evidence, they would produce most of the notable phenomena of glacial periods. For example, they would explain such puzzling conditions as the localization and periodicity of glaciation, the formation of loess, and the occurrence of glaciation in low latitudes during Permian and Proterozoic times. The converse of this is that if the conditions which now prevail at times when the sun is relatively inactive should be intensified, that is if the sun's atmosphere should become calmer than now, and if the proper terrestrial conditions of topographic form and atmospheric composition should prevail, there would arise the mild climatic conditions which appear to have prevailed during the greater part of geological time."

An aerological survey of the United States.—I, Results of observations by means of kites, W. R. GREGG (*U. S. Mo. Weather Rev. Sup. 20 (1922), pp. IV+78, figs. 25*)—Results of observations by means of kites on pressure, temperature, relative humidity, density, and duration and velocity of the wind at aerological stations at Broken Arrow, Okla.; Drexel, Nebr.; Ellendale, N. Dak.; Groesbeck, Tex.; Leesburg, Ga.; Royal Center, Ind.; Blue Hill, Mass.; and Mount Weather, Va., are summarized in tables and diagrams. The results bring out especially the following points:

"(1) The large difference between summer and winter conditions at all levels and at all latitudes; (2) the substantial parallelism in the lines of equal pressure and temperature at all levels; . . . (3) the slight southward trend of isobars and isotherms in the upper levels from the interior to the eastern portions of the country; . . . (4) the higher relative humidity in the South than in the North during summer and the opposite gradient during winter; . . . (5) the close agreement in the summer and winter latitudinal range of vapor pressure at all altitudes; . . . (6) the small latitudinal density gradient in the higher levels, owing to the counterbalancing effects of pressure and temperature, i. e., density varies directly with pressure, inversely with temperature; . . . (7) the small latitudinal difference in resultant wind speeds, due to the fact that these vary directly with the pressure gradient, but inversely with the sine of the latitude. . . . In general, at all altitudes there is a southerly component in summer and a northerly in winter."

Local rain-producing influences under human control in South Australia, E. T. QUAYLE (*Roy. Soc. Victoria Proc., n. ser., 34 (1922), No. 2, pp. 89-104*).—Continuing studies reported in a paper previously noted (*E. S. R., 48, p. 418*), the author made a study of South Australian rainfall in the same way as he had done in case of the rainfall of Victoria and the southern and western parts of New South Wales.

The results of this study indicated that there has been an improvement in rainfall in South Australia similar to that previously observed in Victoria, and that this is probably due to the clearing away of the forest covering in the hilly areas, which "greatly increases the amount and constancy of the flow of the rivers. It thus releases from day to day for storage in inland lakes

and reservoirs vast quantities of water which otherwise would be thrown into the mountain atmosphere, and to a large extent cross the hills, eastwards and southwards, without condensation, and so escape. . . .

"It is more than probable that in the struggle for existence our perennial vegetation has been its own undoing. The very means it has been compelled to take for its own protection have made the climatic environment progressively worse. Whether distinctly drought-resistant or not, it must regulate transpiration so that it is never unduly accelerated, with the result that the hot spells leading up to rainy conditions find inadequate response in evaporation from the country beneath, while the comparative coolness of the shaded land surface helps to prevent convectional action and lessen the frequency of thunder-showers. Moreover, the blocking of the water channels and the prevention of erosion, the drying of the subsoil, and consequent lessened flow from springs owing to the large moisture requirements of the trees all tend to hold the water up against the eastern mountain slopes, where its evaporation is comparatively ineffective in rain production, and away from the depressions in the interior where its evaporation would be most effective in rain production. Hence, the increasing dryness of the interior and the gradual contraction of the belt of perennial vegetation toward the inland slopes and foothills."

SOILS—FERTILIZERS.

Handbook for field geologists, C. W. HAYES (*New York: John Wiley & Sons, Inc., 1921, 3. ed., rev. and enl., pp. XI+166, pls. 3, figs. 20*).—This is the third edition of this handbook, which has been revised and rearranged by S. Paige. It is a convenient and concise description of geologic field methods, comprising information on general practice and instructions for special investigations. A section on mineralogy, prepared by E. S. Larsen, is appended.

A note on the classification of soils on the basis of mechanical analyses, C. L. WHITTLES (*Jour. Agr. Sci. [England], 12 (1922), No. 2, pp. 166-181, figs. 11*).—In a contribution from the Cambridge School of Agriculture, some of the various methods of interpretation of results of mechanical soil analyses are discussed and compared. A bibliography of soil classification, with data for soil types, is included.

Soil survey of Charles County, Md., H. C. SMITH and R. C. ROSE (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 47, fig. 1, map 1*).—This survey, made in cooperation with the Maryland Experiment Station and the Maryland Geological Survey, deals with the soils of an area of 296,960 acres lying on the Western Shore of Maryland. In a broad sense, the county is a well-dissected southerly sloping plain. Over three-fourths of the area is said to be well drained. Some parts of the remaining area have poorly established drainage.

The soils of the county are light in color and occupy a region characterized by mature soils having a low content of organic matter and containing no carbonates in either soil or subsoil. Dark colored soils occur locally, but they are invariably poorly drained and to that extent at least are immature. All of the soils in the county have been developed from beds of sands, silts, clays, and gravels, all so recent in age that they are still unconsolidated. Including swamp, meadow, and tidal marsh, 15 soil types of 6 series are mapped, of which the Leonardtown silt loam and the Sassafras gravelly loam and sandy loam cover 26.4, 17.9, and 15 per cent of the area, respectively. The soils of the Sassafras series are represented by six types and comprise about half of the county.

Soil survey of Stevens County, Minn., P. R. McMILLER ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. 32, fig. 1, map 1*).—This survey, made in cooperation with the Minnesota Experiment Station, deals with the soils of an area of 360,960 acres in western Minnesota. The topography is that of an undulating to rolling glacial drift plain, the eastern, southern, and portions of the northern parts of the county being rolling. The Pomme de Terre River drains large areas in the central and eastern parts of the county. The western part is said to be poorly drained by intermittent draws and open ditches.

The soils of the county are derived largely from unstratified material of glacial origin. Eleven soil types of 6 series are mapped, of which the Clarion silt loam and loam and the Fargo clay loam cover 52.2, 16.5, and 12.1 per cent of the area, respectively.

Soil survey of Pittsylvania County, Va., N. M. KIRK ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 46, fig. 1, map 1*).—This survey, made in cooperation with the Virginia Experiment Station, deals with the soils of an area of 647,680 acres lying wholly within the Piedmont Plateau in southern Virginia. The topography in general is gently rolling to rolling, but in places becomes somewhat hilly. Drainage is said to be well established. The upland soils of the county are of residual origin. Including meadow and rough stony land, 30 soil types of 15 series are mapped, of which the Cecil sandy loam, gravelly fine sandy loam, and fine sandy loam cover 23.1, 16.1, and 13.9 per cent of the area, respectively.

Soil survey of the Wenatchee area, Wash., A. E. KOCHER (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 91, pls. 4, figs. 2, map 1*).—This survey deals with the soils of an area of 370,560 acres lying in north-central Washington. The area includes the eastern part of Chelan County, or all that part not included within national forests. The area is one of marked physiographic contrasts, consisting of rugged mountain ranges, plateaus, and sharply outlined valleys. The area is drained by the Wenatchee, Entiat, and Cheland Rivers.

The soils of the area are of residual and transported origin. The residual soils are derived from igneous and sedimentary rocks, and the transported soils are wind, ice, and water-laid. Including rough, broken, and stony land, rough mountainous land, scrubland, and riverwash, 35 soil types of 18 series are mapped, of which rough, broken, and stony land covers 58.8 per cent of the area. The Wenatchee series is said to be one of the most important in the area.

Physico-chemical studies of soil.—The colloidal function in the soil and the characteristics depending upon it, U. PRATOLONGO (*Sta. Sper. Agr. Ital., 53 (1920), No. 1-3, pp. 5-23, figs. 2; abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr., 11 (1920), No. 7-8, pp. 825, 826*).—Studies to determine the relations existing between the water content of the soil, marked by Van Benmelen's critical point in the vapor tension curve, and the data obtained by the physico-mechanical analysis of the soil, using an easy and rapid method of determining the critical point, are reported. An attempt was made to determine the effect produced upon the position of the critical point by certain physical operations to which the soil is usually subjected. The experiments were made upon 12 soils, some coming from Argentina and others from different parts of Italy.

The comparisons made between the data obtained by physico-mechanical analysis and the results obtained by the above-mentioned method of investigation revealed no relation of dependence upon the physico-mechanical constitution. On the other hand, the data taken as giving the colloidal content of the

soil clearly revealed a sensitiveness to ordinary physical and chemical action which no other characteristic had hitherto attained. The results obtained and the deductions therefrom permit the assignment of a scientific and practical value to Van Bemmelen's critical point, which, it is thought, has proved itself worthy of further study. The behavior of the isotherm of vapor tension on the soil, which is a function of its colloidal content, is another soil characteristic which is considered to be important from the agricultural standpoint.

The soil solution in relation to the plant, D. R. HOAGLAND (*Faraday Soc. Trans.*, 17 (1922), No. 2, pp. 249-254).—In a contribution from the University of California, an elaboration of the dynamic and physico-chemical viewpoint of soils and plants is presented.

Studies conducted at the university to establish more definitely some of the relations existing between the crop, season, and soil solution are reported, in which large quantities of different soils were used. During the early period, while the plants were still very small, an increase was noted in the quantities of nitrate, potassium, calcium, and magnesium extracted from the cropped soils. After the plants had begun to grow more rapidly the amounts of these elements in the extracts began to decrease, and by the time the plants were well tillered and the heading-out stage had been reached, little if any nitrate remained. In general, very significant depressions in the content of soluble potassium, calcium, and magnesium had also occurred. Meanwhile, the uncropped soils failed to show these decreases in the water-soluble nutrients, although marked fluctuations were found which were thought to have been associated with cycles of activity of microorganisms. In the uncropped soils the highest point in the seasonal curve was frequently attained at the time when the cropped soils were at a minimum. The water-soluble constituents of the latter slowly increased in quantity after the periods of greatest depression, but the difference between the cropped and uncropped soils persisted for a long time, sometimes being evident at the beginning of the following season.

These seasonal fluctuations did not seem to hold for phosphate. The water-soluble phosphate on the whole was maintained at a fairly constant level throughout the season, but different soils yielded very different quantities of soluble phosphate. While no marked changes were noted during a single season, some soils showed a decided depression in the solubility of phosphate after a number of years of cropping. This is taken to indicate that the crop does produce an effect on the concentration of phosphate ions in the soil solution. The total quantity of phosphate extracted from a soil was found to be approximately proportional to the amount of water used, which was not true of potassium, calcium, magnesium, and nitrate.

Analyses of crops to study the absorption of nutrient elements are also discussed. Experiments with barley are taken to indicate that both the diminution in concentration of the soil solution and changes in the internal metabolism of the plant are concerned in the phenomenon of loss of nutrient elements from the tops as a whole.

The author is further of the opinion that claims that definite proportions of nutrient elements are essential for optimum growth of a given plant are in no manner justified by the evidence adduced in their support.

The rate of ascent of liquids through granular media, F. E. HACKETT (*Faraday Soc. Trans.*, 17 (1922), No. 2, pp. 260-267, fig. 1).—The results of studies of the capillary ascent of liquids in such media as sands and soils are reported. Sands of different grades were obtained by the use of sieves. Paraffin oil was substituted for water. The ascent was observed in tubes of 2 cm. diameter closed at one end with wire gauze of 200-in. mesh.

It was found that the ascent of liquids in sands which takes place in from 2 to 24 hours, according to the viscosity of the liquid, satisfies the laws of capillary flow for the tube-like spaces between the grains. The ascent may continue for over a year, and the final heights attained may be from two to three times the height reached in the first stage. This second stage satisfies an equation similar to that for capillary flow, but the constants deduced are not in agreement with the theory of capillary flow.

Influence of H-ion on growth of Azotobacter, P. L. GAINES and H. W. BATCHELOR (*Science*, 56 (1922), No. 1437, pp. 49, 50).—In a contribution from the Kansas Experiment Station, studies to determine the influence of the reaction of culture media upon pure cultures of Azotobacter are briefly reported. Several strains of Azotobacter were isolated from different soils and grown in dextrose media of different H-ion concentrations. The maximum H-ion concentration permitting growth was found to be pH 5.9–6 for all strains studied. As the H-ion concentration of the medium decreased, the growth of the organisms increased until a pH of from 6.1 to 6.4 was reached. Here the growth appeared to be quite as vigorous as at lower concentrations.

No nitrogen fixation took place in a H-ion concentration greater than pH 5.9, while fixation in concentrations of pH from 6.3 to 6.5 was as great as in lower concentrations. The optimum reaction for nitrogen fixation appeared to be very closely associated with the optimum reaction for growth.

The total quantity of acid produced by the various cultures was insignificant. The culture medium employed required only about 0.05 cc. of N acid per 100 cc. to produce a change of 0.1 pH in reaction. Only slight changes in the H-ion concentration of the medium were produced by the growth of any strain of the organism. This is taken to indicate the production of inappreciable quantities of either acid or basic metabolic by-products by these organisms.

The lime requirement of some South African soils, T. D. HALL (*Jour. So. African Assoc. Analyt. Chem.*, 4 (1921), No. 2, pp. 3–8).—A comparison of the litmus paper, Truog, and Veitch methods for determining the lime requirement of soils made on 127 soils, representing nearly every district in the Transvaal, led to the conclusion that the Truog method is a far better qualitative test than the litmus paper test. Of the 127 soils, 51.2 per cent were acid while the remainder were alkaline in reaction. Of the acid soils, 75 per cent had a lime requirement of less than 3,000 lbs. per acre by the Veitch method. This is taken to indicate that soil acidity is not likely to be one of the chief drawbacks of South African soils. No relation was found in many soils between the total calcium oxid content and the lime requirement, and other cases showed that a soil can have a low total lime content and yet be only weakly acid or even alkaline in reaction. The Veitch method was found to be affected by the physical as well as the chemical composition of the soil.

The presence of cobalt and nickel in arable soils, G. BERTRAND and MOCRAGNATZ (*Compt. Rend. Acad. Sci. [Paris]*, 175 (1922), No. 2, pp. 112–114).—The results of studies of certain arable soils in Europe including fertile field soils and garden soils are briefly reviewed, indicating that, while the proportions of cobalt and nickel contained in such soils are very small, they are not negligible. A very fertile soil from near Belgrade was found to contain a proportion of oxid of cobalt corresponding to 0.0028 gm. of cobalt per kilogram of soil and of oxid of nickel corresponding to 0.0136 gm. of nickel per kilogram of soil. A sample of garden soil contained 0.0037 gm. of cobalt and 0.0174 gm. of nickel per kilogram of soil.

Plant disease and weeds v. crop rotation, manure, and fertilizers (*North Dakota Sta. Bul.* 159 (1922), p. 7).—Crop rotation, manure, and fertilizer trials

conducted during the past 10 years in connection with studies of the practical management of Fargo clay soil are said to lead to the conclusion that all small grain yields decline under continuous culture, due principally to the competition of weeds, and that neither manure nor artificial fertilizers will increase the yields under continuous culture. Both manure and artificial fertilizers increase small grain yields under rotation culture, but neither have increased wheat yields appreciably during severe black stem rust epidemics. Profitable increases have, however, been obtained during rust-free years.

It is further concluded that in order to arrive at the true effect of a given soil treatment or cultural soil practice, disease-resistant crops must be used.

Fermentation and preservation of manure, I, II (*New York State Sta. Bul.* 494 (1922), pp. 3-74, pls. 6, fig. 1).—These studies are in two parts.

I. *A study of certain bacteria involved in the ammonification of manure*, H. J. Conn and R. C. Collison (pp. 3-27).—Studies on the action of various pure cultures of bacteria on manure, the primary purpose of which was to show their ability to volatilize ammonia when a constant stream of air is passed over the surface of the manure, are reported.

The first organisms tested were mostly those capable of liquefying gelatin, such as *Bacillus cereus* and *Pseudomonas fluorescens*. None of the rapid liquefiers investigated proved capable of giving off ammonia in quantities comparable to those given off from unsterilized manure. Only one organism was found which did give off from manure in pure culture and under laboratory conditions amounts of ammonia equal to or greater than those obtained from unsterilized manure. This organism is a very small, nonspore forming, non-motile, gram-negative rod, which does not liquefy gelatin nor acidify sugars but reduces nitrate quite vigorously to nitrite. It is considered to be possibly closely related to certain nonspore-forming bacteria very abundant in soil. No distinct evidence was obtained that this organism has an actual proteolytic action on the organic matter present in manure. A special description of the organism is included.

II. *A study of certain preservatives and their effect on the fertilizing value of manure*, R. C. Collison and H. J. Conn (pp. 28-74).—The results of laboratory and greenhouse investigations on the nitrogen transformations occurring in horse manure and on methods of preventing nitrogen losses during such changes are reported. Both small portions of manure kept under laboratory conditions and composts large enough to be used in vegetation work were employed.

The laboratory studies indicated that acid phosphate, peat, and gypsum may prevent the loss of ammonia from manure, although in the case of gypsum this saving was apparently balanced by a decided loss of elementary nitrogen. The ammonia loss was prevented either by chemical action, by physical absorption, or by changing the kinds of organisms living in the manure.

Since varying the conditions of experimentation altered greatly the fate of the nitrogen in manure, it was concluded that laboratory work alone, either with unsterilized or with artificially inoculated manure, could not solve the problem of manure preservation or give conclusive information concerning the nitrogen changes under practical conditions. The laboratory experiments were therefore supplemented by more practical ones with composts of larger size containing the manure and preserving agents, and vegetation work was conducted as an indicator of the relative amounts and availability of the nitrogen left after composting. In these experiments acid phosphate and peat proved to be very efficient preservatives of manure, preventing undesirable nitrogen changes. Gypsum did not prove as effective in this respect, and rock phosphate was still less so.

The plant cultures having the composts as the sole source of nitrogen varied in the oven-dry weight of their tops in direct proportion to the amount and availability of the nitrogen in the composts. The organic nitrogen left in the composts seemed to be more readily available in the manure with which acid phosphate and peat had been composted. Wheat straw appeared to be very detrimental to the growth of barley and rape.

The results of these studies are taken to indicate that acid phosphate and peat are efficient preservatives of horse manure.

Acid phosphate, a good manure preservative, J. D. LUCKETT (*New York State Sta. Bul.* 494, pop. ed. (1922), pp. 7, fig. 1).—This is a popular edition of the above.

The production and utilization of manure on Illinois dairy farms, H. A. ROSS (*Illinois Sta. Bul.* 240 (1922), pp. 471–489, figs. 3).—The result of a study made to ascertain the amounts of manure recovered and applied to the fields under general dairy farm conditions in Illinois, to show the common practice of progressive farmers in the utilization of manure and to present data on the labor cost of hauling and spreading, are presented in this bulletin. The data were derived from 224 farm records of one year each and involve an aggregate amount of 65,471 loads of manure recovered.

The average amount of manure recovered annually was 6.6 loads for each of the 7,161 dairy cattle units, and 5.45 loads for each of the 2,229 work animal units which were maintained on these farms. These amounts include both the clear excrement and the bedding. With the system of manure management which was practiced on these farms, an average of 30 dairy cattle units per 100 acres of tillable land would be necessary in order to provide sufficient manure to annually cover one-fifth of the land at the rate of 10 loads per acre. Approximately one-third of the acreage of these farms was in corn, and to this one-third was applied two-thirds of the recorded manure. The greater part of the remaining one-third was applied to hay and small grain crops.

On the farms studied, 45.5 per cent of the total amount of manure recovered was hauled during the months of March, April, and May, and of this amount over 70 per cent was applied to corn. June, July, September, and October were the months in which the least amount of manure was hauled. The average amount of labor required in hauling and spreading a load of manure was 1.05 man hours and 2.19 horse hours. The labor per load was least during the months when the greatest amount of manure was hauled.

Substitution of green crops and commercial fertilizers in place of stable manure, T. C. JOHNSON (*Amer. Fert.*, 57 (1922), No. 2, pp. 26–28).—Studies conducted at the Virginia Truck Experiment Station to determine (1) the relative efficiencies of the several sources of fertilizer materials generally used in the compounding of fertilizer commonly employed by the truck farmers of eastern Virginia, (2) the effects of using large amounts of fertilizers in the production of crops as compared with small amounts, and (3) the practicability of substituting green crops turned under in the place of stable manure are reported. The soil used was Norfolk gravelly loam.

Where 4,000 lbs. of commercial fertilizers were used per acre and where crimson clover had been grown and lime applied, the largest average yields of kale and cabbage were obtained. The yields of all crops were greater where crimson clover and cowpeas had been grown and lime applied than on plats which had been treated with stable manure without lime. On plats receiving no fertilizers, liming was beneficial in the production of sweet potatoes. The cover crops turned under had a relatively greater influence than stable manure. Yields obtained where stable manure and legumes but no commercial fertilizers were used were very low with the single exception of sweet potatoes. Where

the commercial fertilizers were used in addition to the organic materials, the yields were even more striking than where lime was used with the organic materials.

It is considered advisable to use both commercial fertilizers and organic matter in truck crop production, and where intensive successive cropping is not followed it is thought that the organic matter may be advantageously obtained from legumes and cover crops.

Green manuring, I, II, H. J. PAGE (*Jour. Min. Agr. [London]*, 29 (1922), Nos. 2, pp. 104-112; 3, pp. 240-248).—In a first contribution to the subject from the Rothamsted Experimental Station, the general features of green manuring are discussed and the results of experiments which have been in progress for over 20 years are summarized. In the second part the effect of green manure on the succeeding crop as compared with that of barnyard manure is considered, according to its influence on the supply of mineral nutrients to the main crop, the supply of nitrogen to the main crop, and on the physical properties of the soil. Owing to the lack of precise data concerning the economic value of green manures, no final conclusions are drawn, although the experimental results indicate an obviously beneficial effect of green manures on winter wheat.

Studies on the decomposition of some common green manuring plants at different stages of growth in the black cotton soil of the Central Provinces, D. V. BAL (*Agr. Jour. India*, 17 (1922), No. 2, pp. 153-151).—Observations on the rate of growth of *Crotalaria juncea* and *Secbania aculeata* in black cotton soil are reported, showing that the latter grows comparatively slowly in its initial stages.

It was found that as the green plants advance in age the proportion of leaf to stem decreases and the percentages of dry matter and fiber increase. The earlier *C. juncea* was used as green manure the more rapid was the decomposition of its carbonaceous and nitrogenous constituents. There was no marked decrease in the rate of nitrification of the comparatively older *S. aculeata* plants, although there was a certain amount of decrease in the decomposition of carbonaceous constituents.

The nitrogen in the leaves of the *C. juncea* was more easily nitrified than that in the stems. The stems of this plant did not appear to have any retarding influence on the decomposition of the leaves in the black cotton soil. The slowness of decomposition of the full-grown plants was not due to any influence of the increasing proportion of stems to leaves. It is thought possible that this may be due to the change in decomposition of the plants and to such alterations as take place in the physical condition of the plant tissues owing to a large reduction in the water content.

The question of raw humus fertilization, SWART (*Ztschr. Forst u. Jagdw.*, 54 (1922), No. 7, pp. 393-401).—The results of studies on the use of raw humus materials for the fertilization of soils growing young pine trees are summarized. The conclusion is drawn that the result of this practice depends on the moisture content and the fertilizer. It is thought that the young pine trees are best nourished by raw humus when this material is intimately mixed with the surface of a mineral soil in such a manner as to promote the most favorable moisture conditions. In dry regions the top layer of soils planted to seedlings should not be mixed with raw humus except in very small amounts.

The fertilizing value of rain and snow, F. T. SHUTT (*Canada Expt. Farms, Div. Chem. Interim Rpt.*, 1921, pp. 13-16).—The data for the fourteenth year of this inquiry (*E. S. R.*, 45, p. 818) are recorded and discussed and the data for the entire period summarized.

During the year ended February 28, 1921, 78 samples of rain and 29 of snow were analyzed. The total amount of nitrogen precipitated during the year amounted to 6.525 lbs. per acre, while the average for the 14 years of the investigation was 6.541 lbs. per acre.

A review of the results of this work for the first 10-year period indicates that the largest monthly amounts of nitrogen usually appear in April and May, and that these amounts are not directly proportional to the rainfall. The greater part of this nitrogen is present in the forms of free ammonia and nitrates. The results for the year differed from preceding data in showing that the rain and snow, considered weight for weight, are almost of equal value as regards nitrogen content. In previous years the results have indicated that rain was decidedly richer than snow in all of the nitrogen compounds, and especially in free ammonia. Considering the rain and snow simply as sources of plant nutrients, their value per acre per annum in the Ottawa Valley district is estimated conservatively at \$1.75.

Fertilizers for field crops: Their nature, functions, and application, with results from recent experiments in Canada, F. T. SHUTT and B. L. EMBLIE (*Canada Dept. Agr. Bul. 8, n. ser. (1922), pp. 64*).—This bulletin presents the results from recent field experiments on the use of fertilizers, conducted at the Dominion Experimental Farms, discusses the source, nature, function, and value of the various manures, fertilizers, and soil amendments, explains the formulas and factors involved in the valuation of fertilizers and preparation of home mixtures, and gives practical suggestions for the fertilizer treatment of field crops adapted to Canadian conditions.

The fixation of atmospheric nitrogen, F. HUGHES (*Egypt Min. Agr., Tech. and Sci. Serv. Bul. 20 (1922), pp. 13, pls. 3*).—In a communication made to the Cairo Scientific Society, a comprehensive summary of methods for the fixation of atmospheric nitrogen is presented.

The subject is brought up for consideration in view of the suggestion to use some of the water power available at Aswân for the production of fertilizers. An appendix containing the results of some pot experiments with nitrogenous fertilizers on maize is added. The fertilizers included sodium nitrate, ammonium sulphate, cyanamid, calcium nitrate, castor meal, sewage sludge, and ammonium nitrate. The two organic manures had little beneficial influence. Ammonium sulphate was 92 per cent as effective as sodium nitrate, ammonium nitrate 98 per cent, cyanamid 59 per cent, and calcium nitrate 104 per cent. The slowness of action of organic manures appeared to be due to a failure to convert the organic nitrogen into ammonia rather than to a failure to change the latter to nitrate.

Nitrogen fixation by the cyanid process, F. E. BARTELL (*Jour. Indus. and Engin. Chem., 14 (1922), No. 8, pp. 699-704, figs. 5*).—In a contribution from the University of Michigan, studies of the cyanizing end of the ammonia process are reported. The studies were conducted with 4-in. batch retorts, having a capacity of 8 lbs. of briquets, and with technical sized 8-in. continuous retorts, having a maximum cyanizing capacity of not less than 50 lbs. of cyanized briquets per hour.

In studying the progress of the cyanizing reaction in the 4-in. retorts, the retort was arbitrarily divided into five zones, heated to approximately the same temperature, and the extent of reaction in the zones was compared. The amount of cyanid formed in each zone was largely dependent on the concentration of carbon monoxid gas in that zone, a high concentration of the gas holding down cyanid formation.

Some of the carbon used in cyanid formation came from decomposition of carbon monoxid. Iron used in the original mixture was oxidized to Fe_2O_3 and Fe_3O_4 during the process of making and drying the briquets. The reduction of this oxid during the cyanizing process was slight in the upper heat zones, even though it was in the presence of carbon and carbon monoxid at $1,000^\circ \text{C}$.

The paper also records large-scale work in which 3 to 12 day runs were made. The work was done in 8-hour shifts, and yields were based on the performance of each shift. A normal production of 7 to 8 lbs. of sodium cyanid per retort per hour was obtained, and this was finally increased to as high as 12.19 lbs. per retort per hour.

Conservative cost estimates showed that ammonia could be produced by this method for approximately 30 cts. per pound, which represented a cost of cyanid production in briquets of approximately 10 cts. per pound.

The citric solubility of mineral phosphates, J. F. TOCHER (*Jour. Agr. Sci. [England]*, 12 (1922), No. 2, pp. 125-143, figs. 8).—In a contribution from the University of Aberdeen, Scotland, studies on the citric solubility of mineral phosphates are reported, from which the conclusion is drawn that the only practical tests of phosphatic fertilizers of value from the agricultural standpoint are those for total phosphatic content, degree of fineness of grinding, and freedom from injurious substances and substances inhibiting plant growth. Citric solubility is considered to be an unreliable empirical test of the agricultural value of mineral phosphates and slags. "It has yet to be shown that high citric solubility is a measure of the presence of phosphate in a readily available condition for plant growth, or is an indication of the presence of a highly citric soluble phosphatic compound of a known chemical constitution."

Nauru and Ocean Island: Their phosphate deposits and workings, H. B. POPE (*Agr. Gaz. N. S. Wales*, 33 (1922), No. 6, pp. 391-402, pls. 2, figs. 2).—This is a brief history of the phosphate deposits on Nauru and Ocean Island, with particular reference to their ownership and operation. It is estimated that on these islands there are not less than 100,000,000 tons of some of the highest grade phosphate known to exist. Throughout a period extending over 21 years the cargoes shipped from both have consistently averaged from 85 to 88 per cent of tricalcium phosphate.

Potash, S. J. JOHNSTONE (*London: John Murray, 1922, [2. ed.], rev. and enl., pp. X+122*).—This is the second revised and enlarged edition of this book, which gives a general account of the occurrence and commercial utilization of potash, particularly in the British Empire. It contains chapters on deposits of soluble potash minerals, salt lakes and pans, potassium nitrate deposits of mineral origin, potassium nitrate deposits of organic origin, sea water as a source of potash, insoluble potash minerals, flue gases as sources of potash, and vegetable sources of potash.

A list of 179 references to literature on the subject is appended.

Sulphur as an oligodynamic substance, E. ROSETTI (*Italia Agr.*, 58 (1921), No. 9, pp. 261-264, figs. 2; *abs. in Chem. Abs.*, 16 (1922), No. 5, p. 782).—Preliminary studies conducted on three types of soil with (1) acid phosphate and sulphur, (2) acid phosphate, (3) sulphur, and (4) tetrphosphate as fertilizers, to determine the nature of the action of sulphur in soils, are reported.

Sulphur did not have a sterilizing action in soil as far as an influence on the growth of legumes was concerned. It exerted a positive influence on the growth of legumes, attributed to the oxidation of the sulphur to sulphuric acid and the subsequent formation of calcium sulphate, which is considered to increase the availability of soil potash. It is also thought that the soil phosphates are made more available by the acid and that the sulphur acted as a

plant nutrient. The increase in yield was constant on all plats receiving sulphur. No evidence was obtained that sulphur acts as a catalytic substance. The beneficial influence of tetrphosphate was found to be much inferior to that of acid phosphate.

AGRICULTURAL BOTANY.

Development and activities of roots of crop plants, J. E. WEAVER, F. C. JEAN, and J. W. CRIST (*Carnegie Inst. Wash. Pub.* 316 (1922), pp. VI+117, pls. 16, figs. 40; *rev. in Science*, 56 (1922), No. 1445, pp. 283-285).—In continuation of previous investigations on root development in grassland formations (E. S. R., 45, p. 732), the authors give an account of studies of the growth, distribution, and physiological activities of roots of a number of crop plants, the experiments having been carried on in 1919-1921 at four places between the Missouri River and the Rocky Mountain region. Plants were grown under field crop conditions and in special cylinders, and the absorption of water and nutrients determined at various stages of growth. A direct correlation was found between the development of tops and roots of crops and that of the native vegetation growing in the same general environment. The depth of root penetration was found to increase eastward from the short-grass plains into regions where the subsoil is constantly moist.

The absorption of water and nitrate of soda, distributed in definite amounts at regular levels in the cylinders, showed that oats absorbed water to a depth of 2.5 ft., barley 3.5, corn 5, and potatoes 2.5 ft. All the plants absorbed nitrates about in proportion to the penetration and distribution of the roots. Where roots came in contact with a fertilized layer of soil they developed more abundantly, branched more freely, and the presence of such a layer seemed to retard normal root penetration into the soil below.

The authors conclude that the deeper soils are not only suited to plant life, but that they play an exceedingly important part in the life of the plant and deserve careful consideration in a study of crop production.

The feeding power of plants, E. TAVOG (*Science*, 56 (1922), No. 1446, pp. 294-298).—The author considers the information regarding the acidity of plant juices gained by the use of the H-ion electrode to be of great aid in clarifying the conception of the feeding power of plants and the relation of plant growth to soil acidity and alkalinity.

On the basis of his studies, he considers that the differences in the feeding power of agricultural plants are not due primarily to differences in the amounts or kinds of acid excreted but to several factors, among them external equilibrium conditions around the feeding roots and the internal equilibrium conditions within the plant, etc.

It is claimed that where two soluble products are formed in the feeding region of the roots due to the action of carbonic acid on a mineral, as is the case with rock phosphate, the feeding power of the plant follows the law of mass action and chemical equilibrium, being dependent on the removal of both the soluble products either by the plant or partly by the plant and partly in other ways. If only one soluble product is formed, as is the case with feldspar, the feeding power of the plant for potassium depends upon its ability to utilize potassium from a dilute solution which, in turn, depends largely on the acidity of the plant sap. The less acid the sap the greater the ability of the plant to utilize potassium from this source. The feeding power of a plant for calcium is dependent upon the reaction of the plant sap, but the relation is opposite to that of potassium, in that the more acid the plant sap the more easily can the plant compete with another acid system

for needed basic material. In the case of base-forming elements, the relation of the feeding power for these to plant sap is considered probably the same as for potassium. While there may be other factors which affect the feeding power of a plant, the author considers it probable that the ones cited often exercise a controlling influence.

The effect of H-ion concentration upon the growth of seedlings, L. W. TARR and S. C. NOBLE (*Delaware Sta. Bul. 131 (1922), pp. 52, figs. 11*).—Following a series of experiments with 10 nutrient solutions, the authors grew seedlings of wheat, soy beans, and corn in a modified McCall solution that was maintained at constant concentrations from pH 3 to pH 8, the cultures being maintained at differences of 1 pH. Potassium acid phthalate was used as a buffer, and ferric phosphate was added to supply iron.

Maximum growth of wheat seedlings took place at reactions of approximately pH 4. A greater concentration of H-ions than this proved harmful, while a lesser concentration exerted no harmful effects until a value of pH 6 was reached. At this concentration chlorosis appeared in the seedlings. Maximum growth of soy beans was attained at approximately pH 5, and at a reaction of pH 4 harmful effects upon the seedlings were apparent. For corn, maximum growth occurred at approximately pH 5, and a reaction of pH 4 exerted a harmful effect. Chlorosis became apparent both with soy beans and corn at about pH 6. It is claimed that chlorosis was due to the insolubility of iron at all H-ion concentrations less than pH 6.

Growth of plants in artificial light from seed to seed, R. B. HARVEY (*Science, 56 (1922), No. 1448, pp. 366, 367*).—A preliminary account is given of experiments by which the author produced good seed from plants grown entirely in artificial light. Among the plants experimented upon were several varieties of wheat, oats, barley, rye, potatoes, buckwheat, lettuce, beans, peas, clovers, radishes, flax, and a number of common weeds. The light for the experiment was obtained from tungsten filament nitrogen-filled lamps which were operated for 24 hours each day. All the plants tested, except cabbage, bloomed and each variety does not seem to require any particular period of illumination to cause blooming. Four ranges of light intensity were used and a number of plants bloomed in all of them, although the illumination was continuous.

Water culture experimentation, W. F. GERICKE (*Science, 56 (1922), No. 1450, pp. 421, 422*).—In a study of methods for water cultures, the author grew wheat for a period of three months, which included the heading out stage of plants, in a combination of single salt solutions of potassium nitrate, calcium sulphate, and dibasic magnesium phosphate, to which a trace of iron was added. Plants grown in these solutions were said to be equal or comparable in their various features of growth, including that of total dry weight, to those of plants grown contemporaneously in complete well-balanced nutrient solutions. The salts named appear to be the only three that can be used as a combination that permit of normal and undiminished growth of wheat. This is the conclusion arrived at from an investigation of culture tests using salts in combinations previously noted (*E. S. R., 44, p. 130*).

Because the monobasic phosphates given in the plan above were found too acid, the dibasic phosphates of calcium and magnesium were substituted, and it appears that by using the proper salts, wheat plants will grow as well with only two nutrient elements present in the media at one time, exclusive of a trace of iron, as they do in complete nutrient solutions. The sets of plants that made the best growth, in combinations of one-salt solutions named, were apportioned among the solutions as follows: Four days continuously in potassium nitrate, one day in calcium sulphate, and one day in dibasic magnesium phosphate. On

the seventh day plants were transferred back to the potassium nitrate solution and the sequence continued. The plants were rinsed in distilled water with every change of culture from one solution to another. Whether this apportionment of exposure of the plants to the different culture solutions would prove the best for the growth of plants can not be stated, as the plants had not matured.

Photoperiodism of wheat, a determining factor in acclimatization, H. M. WANSEER (*Science*, 56 (1922), No. 1446, pp. 313-315).—A preliminary account is given of experiments with winter and spring wheats which were made to determine the effect of the photoperiod, as previously defined (E. S. R., 47, p. 225).

From a preliminary experiment, the author claims that a proper adjustment of the daily exposure to light, independent of temperature, will control the type of growth in the winter wheat plant, and by regulation of this factor it is possible to induce the jointing and heading stages irrespective of season. In addition, there was found a minimum stimulating photoperiod for the control of each of these stages of growth in the winter wheat plant. It is believed that the northern limits of distribution of winter wheat are probably very largely controlled by the relation of the date of the beginning of the active growing season to the date at which the longest day within the limit of the critical photoperiod for jointing occurs in that locality.

While the photoperiods for jointing and heading do not overlap and are entirely distinct in the case of winter wheat, they were found less distinct for spring wheats. In the latter group the photoperiod for jointing is of greater magnitude than in the former, possibly without a maximum limit, and jointing and heading are possible under more nearly an identical photoperiodic stimulus. It is claimed that photoperiodism is the key to the distinction between winter and spring wheats.

[Selections in exclusively vegetatively propagated potato crops], C. J. J. VAN HALL (*Teymannia*, 31 (1920), No. 11-12, pp. 519-527).—The question as to whether a potato stock propagated vegetatively can be improved by selection among the vegetatively produced descendants is answered in the negative, except so far as selection is made for disease resistance, as in case of mosaic or leaf roll.

Symbiotic nitrogen fixation by leguminous plants, with special reference to the bacteria concerned, R. HANSEN (*West. Canad. Soc. Agron. Proc.*, 1 (1920), No. 1, pp. 105-116, *figs.* 6).—Of nonlegumes bearing root nodules and thought to utilize atmospheric nitrogen, none justified this expectation when tested. It was found that the root nodules differ morphologically from those on leguminous plants. They are not caused by the bacteria which cause the nodules on legumes, but probably by a fungus. The conclusion is that the symbiosis is confined, so far as we know, to the Leguminosae.

Notes on the cytology and genetics of the genus Fuchsia, R. BEER (*Jour. Genetics*, 11 (1921), No. 3, pp. 213-227, *pls.* 3).—Of earlier studies by the author connected with supernumerary pollen grains of Fuchsia and their mode of development, and later studies of the cytological features connected with the development of supernumerary pollen grains in certain species and hybrids of Fuchsia as carried on concurrently with studies on the genetics of the genus, the more recent investigations are presented and discussed in some detail.

A study of the variation in seedlings of the wild hop, E. S. SALMON and H. WORMALD (*Jour. Genetics*, 11 (1921), No. 3, pp. 241-267, *pl.* 1).—The study here described is said to show that the wild species *Humulus lupulus* is composed of a number of forms with distinctive morphological and physiological

characters. Forms similar morphologically (for the characters taken) possess distinctive physiological characters as regards differences in reaction to mildew attack.

Male sterility in flax, subject to two types of segregation, W. BATESON and A. E. GAIRDNER (*Jour. Genetics*, 11 (1921), No. 3, pp. 269-275, pl. 1).—In 1912 a plant of *Linum grandiflorum* was noted which appeared unique in a procumbent habit when young, a very pale style, and very late flowering. This was crossed in 1916 with a tall, white-flowered fiber flax. The purpose of this paper is to record the facts respecting the behavior of a male-sterile form which appeared in the F_2 in 1918.

While in previous experiments on the genetics of male sterility in flax the male steriles were introduced as an already recognized type, in this work they arose in the F_2 from a cross between two fully hermaphrodite types. Subsequent experience proved that the new form was brought in by the pollen of the common flax, and that the procumbent is genetically hermaphrodite on both the male and female sides. Further data and deductions are indicated.

Note on the detection of segregation by examination of the pollen of rice, F. R. PARNEIL (*Jour. Genetics*, 11 (1921), No. 3, pp. 209-212, pl. 1).—A study is reported as applied to the inheritance of the so-called glutinous character typical of a small group of cultivated varieties of rice, the grains of which become gelatinous when cooked in water. The action of dilute iodine shows in these grains a reddish color, passing through wine color to dark brown as the strength is increased. This change is presumably due to the presence of amylopectin, which is supposed to confer the glutinous quality. Inheritance studies led to the conclusion that the single factor explanation of the difference between starchy and glutinous is correct, but that some disturbing influence affects the ratios in F_2 . Certain preliminary results suggest that differential germination and dying off may be responsible.

Two types of pollen appear on treatment with iodine, apparently mixed throughout all parts of each pollen sac.

An unsuccessful attempt was made to determine at what stage in spermatogenesis segregation occurred. It is thought probable that a systematic search in other plants would reveal many cases of similar dimorphism in pollen, for example, in the form of starch, its presence and absence, or the presence and absence of other substances recognizable by microchemical tests. This line of work is thought to offer possibilities as regards determining the stage at which segregation takes place.

Inheritance of glandular pubescence in *Crepis capillaris*, E. B. BABCOCK and J. L. COLLINS (*Science*, 56 (1922), No. 1449, p. 392).—It is stated that the usual wild type of this species has glandular pubescence on the involucre bracts, extending downward on the pedicel for some distance. In 1918 a single plant appeared which did not have these glandular hairs, and such plants have been designated as bald. Subsequent studies have shown the appearance of bald plants in a number of cultures derived from different localities, and the identity of the gene has been established by crossing, which in all cases produced only bald plants. The bald character is said to be produced by single recessive genes. F_1 plants obtained from crossing bald with glandular were completely glandular. F_2 bald plants which were tested bred true in subsequent generations.

A case of duplicate genes in *Crepis capillaris*, E. B. BABCOCK and J. L. COLLINS (*Science*, 56 (1922), No. 1449, p. 392).—The rosette leaves of *C. capillaris* are said to have a more or less pronounced pubescence on the lower surface of the midrib. In 1918, from a culture which had its origin in wild plants

growing at Berkeley, Calif., there was found a plant which did not show this pubescence. When selfed this plant reproduced the type, and a strain of smooth leaved plants was established. More recent study is said to show that hairiness of the midribs is due to duplicate dominant genes which are not in the same chromosome group.

An albino mutation of the dematiaceous fungus *Brachysporium trifolii*, L. BONAR (*Science*, 56 (1922), No. 1443, pp. 226, 227).—In a previous publication (E. S. R., 46, p. 743) the author described a wilt of white clover due to *B. trifolii*. Since that time cultures have been maintained from a single spore. In November, 1921, an albino form appeared in one sector of culture, and this remained constant through 16 subcultures. There is a complete loss of the dark color which is characteristic of the normal strain.

A damp chamber for microscopes, C. H. FARR (*Science*, 56 (1922), No. 1443, pp. 227, 228).—A description is given of a type of a damp chamber that has been found especially adaptable to the study of hyphae under the microscope.

FIELD CROPS.

[Report of field crops work in North Dakota, 1920–21] (*North Dakota Sta. Bul.* 159 (1922), pp. 5–7, 7–11, 20, 22, 23, 29, 30, 32, 33, 35, 36, figs. 2).—The continuation of earlier work (E. S. R., 45, p. 225) is reported.

In a 4-year comparison, wheat after clover averaged 22.2 bu., after potatoes 20.5 bu., and after corn 20.4 bu. However, in the period 1913 to 1921, wheat after corn outyielded wheat after potatoes by 1.4 bu. The application of farm manure caused average increases over unmanured plats of 12.5 per cent with wheat after corn, 8.5 per cent with corn for fodder, 22.6 per cent with fodder corn after wheat, and 18.9 per cent with barley after wheat. In 4 rust years manure returned an average annual increase of only 0.75 bu. of wheat, and in 5 rust-free years 4.1 bu. Manure failed to return any appreciable benefit when used in continuous wheat growing. In tests of the effect of phosphate fertilizers with wheat on Fargo clay, untreated plats averaged 19.4 bu., crop residue plats 20.4 bu., and plats receiving both crop residues and phosphate 21.8 bu. In the 5 years when black stem rust was not a serious factor, phosphate fertilizers increased the wheat yield 9 per cent.

Plantings of winter rye made weekly, beginning September 11, gave indications that winter rye will head out the following season if the seed sprouts before freezing and thawing ceases in the spring. The dying of seedling plants from the drying out of the top soil, associated with root blighting, was observed to occur after growth was over in the fall and before growth started in the spring. Tests show that running a packer over winter wheat and rye just before the fall freeze-up and again as early as possible in the spring is a very profitable practice.

Milling and baking tests demonstrated that the quality of the 1919 hard red spring and durum wheat was better than that of the 1920 crop. The lower grades in the amber durum and red durum subclasses tended to produce the larger loaf volume. Data from a study of the flours from strong and weak wheats indicate that the calcium and magnesium content of the ash varies directly with the loaf volume, high loaf volume is associated with high nitrogen content, and the nitrogen-ash ratio appears to increase with the loaf volume.

Spring wheat and Sixty-Day oats made nurse crops particularly favorable for seed production in sweet clover, whereas seed yields were very low where barley was used. Seeding trials indicate that sweet clover may be safely sown in the Red River Valley from early April to the middle of June, but that

there is some advantage in early seeding. The use of a nurse crop seems to favor seed production the following year.

The number of days required to bring 16 corn varieties to different stages of development are tabulated for the season of 1920. Comparisons of the growth of Northwestern Dent corn and Mammoth Russian sunflowers show that sunflowers are able to make much more growth in the same length of time than corn and withstand prolonged coolness better.

Plant breeding work with wheat, corn, alfalfa, and brome grass is noted. A strain of Grimm alfalfa secured through self-fertilization for two generations sustained only 4 per cent of killing during 3 winters as compared with an average killing of 40 per cent with all strains.

Flax planted early in May gave best results, while late flax rusted badly and suffered from canker. Flax plantings from April 21 to May 7 showed frost damage from 0 to 16 per cent. Repeated trials demonstrated that flax thrives after fall-plowed sod crops and yields satisfactory when seeded early on corn stubble land. N. D. R. No. 114, a small-seeded, wilt-resistant variety, is considered the only safe flax to grow when wilt disease is present in the soil. Flax cultivated in rows 28 to 36 in. apart averaged for 6 years 9.06 bu. per acre as compared with 8.45 bu. from solid flax areas. Although pigeon grass in the rows could not be kept down except by hand weeding, it did not seem to reduce yields appreciably.

Treating potatoes with corrosive sublimate after cutting resulted in a yield 28 per cent lower than with treatment before cutting. Seed potatoes dried for 3 days after cutting yielded 11 per cent less than undried seed. Differences in the yields from stem ends and seed ends were not apparent. Little direct injury to the potato eyes was found, sprouted seed being less injured than dormant seed. However, the cut surfaces were greatly injured. Seed pieces dug up after sprouts had emerged appeared to be eaten by the chemical, and some, which had little left but shell on which the eyes were located, developed a very weak sprout or none at all. The longer the pieces remained in the ground the deeper the tuber was corroded. Potatoes watersoaked at 35° F. for 2 weeks gave a perfect germination, while longer than 2 weeks caused increasing amounts of damage as shown by poor germination, but the extent of damage was not observable. Potatoes withstood but 3 days' soaking in water at 60°, and the very apparent injury to the tubers consisted of soft rotten spots.

Continued experiments at the Dickinson Substation (E. S. R., 44, p. 30) are summarized. The respective acre yields of wheat and oats following disked corn were 21.3 and 43.1 bu., spring plowing 17.6 and 36.3 bu., fall plowing 17.8 and 35.2 bu., fallow 23.9 and 47.3 bu., and green manure 19.2 and 43 bu. The leading varieties of cereals to date include Monad and Kubanka durum wheat; Marquis common wheat; Victory, Silvermine, Big Four, and Early Mountain oats; Hannchen and Swan Neck barley; N. Dak. No. 959 winter rye; Damont, N. Dak. R. No. 52, and Russian flax; and Northwestern Dent and Gehu Flint corn. Burbank averaged highest of 5 standard potato varieties, with Irish Cobbler and Early Ohio yielding slightly less.

[Report of field crops work at the Edgeley Substation in 1921], O. A. THOMPSON (*North Dakota Sta. Bul. 161 (1922), pp. 5-12*).—Agreeing with the 14-year averages noted (E. S. R., 45, p. 225), wheat, oats, and barley, continuously, showed increased yields as compared with alternate cropping with summer tillage, while corn exhibited a slight decrease. Wheat and oats after fallow in rotation outyielded the same crops after small grain in rotation. Wheat yields after green manure of peas exceeded yields after summer fallow, while wheat after rye and after sweet clover made about the same as after

fallow. Oat yields were in favor of the fallow. Wheat and oats on manured fallows showed decreased yields, probably due in large measure to lodging. Wheat and barley grown on corn land produced a slight increase as compared to fallow, while fallow favored oats. Oats grown after clover produced more than after alfalfa, brome grass, and small grains. Wheat, oats, and barley have usually given better yields when grown after corn than when grown continuously or following small grain in rotation, indicating that crop yields are probably influenced more by the amount of moisture left in the soil by the preceding crop than by the effect of the crop itself. Fall plowing slightly favored wheat and oats in 1921, while barley and corn made better yields with spring plowing. Wheat and oats yields on disked corn land were slightly in excess of those on plowed land.

In the variety trials durum wheats averaged 11.4 bu., life wheats 5.2 bu., Preston 6.8 bu., and bluestem 4.3 bushels per acre; Big Four oats led with 32 bu., and Manchuria barley with 12.7 bu. Early potatoes averaged 44.2 bu. and late varieties 32 bu.

Yields from fertilizer trials on the live stock rotation system and the cash crop rotation system in 1921 are tabulated without comment.

Interim report of the Dominion agrostologist, M. O. MALTE (*Canada Expt. Farms, Div. Forage Plants Interim Rpt., 1921, pp. 38, figs. 21*).—Experiments reported for the year ended March 31, 1921, supplementing earlier work (E. S. R., 45, p. 822), included variety trials with silage corn, mangels, swedes, field carrots, sugar beets, and red clover; breeding work with mangels, carrots, red clover, alsike clover, alfalfa, timothy, western rye grass, orchard grass, meadow fescue, and blue grass; spacing tests with sunflowers; field trials with miscellaneous grasses; and seed production studies.

Although no material difference in vitality exists between hulled and unhulled timothy seed sown a year after harvest, comparative trials indicated that hulled seed loses its vitality with age more quickly than unhulled seed. In 1919, unhulled seed, 3 years old, yielded 2.42 tons per acre, whereas hulled seed of the same age made but 1.69 tons. The various forms of western rye grass were observed to be normally self-fertilized, permitting development of distinct varieties by propagation of wild forms. Varieties so isolated varied widely in both seed and forage production. Self-fertilized mangels did not exhibit decreased seed production.

[**Root crops experiments in Canada**], F. T. SHUTT (*Canada Expt. Farms, Div. Chem. Interim. Rpt., 1921, pp. 18-29*).—Analyses and yields are given of sugar beets produced from Canadian-grown seed at experimental farms across the Dominion, with brief statements of the soil and season and the quality of beets in each locality. Averages of all stations showed from 16.31 to 16.48 per cent of sugar in the juice and coefficients of purity of from 83.54 to 84.11.

The respective average percentages of dry matter in 42 varieties of mangels tested for 16 years, 21 varieties of turnips for 15 years, and 15 of carrots for 15 years amounted to 11.01, 10.63, and 10.76, and the sugar in the juice averaged 5.66, 1.27, and 2.86 per cent, respectively.

[**Field crops work in Iceland**], E. HELGASON and S. SIGURDSSON (*Búnadarrit [Reykjavík], 34 (1920); abs. in Nord Jordbrugsforsk., 1921, No. 4, pp. 146, 147*).—The work at the experiment stations at Reykjavík and Akureyri comprised varietal trials of root crops, potatoes, oats, barley, forage grasses, and vegetables, tests of ornamentals; and fertilizer experiments. The Icelandic soils are generally poor in nitrogen and phosphoric acid, but possess an abundance of potash. However, potash fertilizers are considered desirable with potatoes or when basin irrigation is employed.

Results with forage crops recommend the culture of *Poa trivialis*, *P. pratensis*, *Festuca rubra*, *Phleum pratense*, *Alopecurus pratensis*, *Bromus inermis*, *B. arvensis*, *Agrostis alba*, *Aira caespitosa*, *Vicia cracca*, and *Trifolium repens*. *T. pratense* and *T. hybridum* gave practically negative results. *Phleum pratense* made an 18-year average of 4,800 kg. per hectare (4,272 lbs. per acre), while the Poas averaged slightly more than 4,000 kg. *Alopecurus* is indicated as the leading forage grass on moraine soils sufficiently warm and moist. The leading root crops averaged 30,000 kg. per hectare, with White Globe, Fynsk Bortf, Gray Stone, and Red American turnip in the first rank. Bangholm, Trondhjem, and Icelandic were outstanding among the kohlrabi varieties. Harbinger, Remarkable, Beauty of Hebron, Agnell, Early Goldstream, Eckenbrecker, Orth, Bodopotet, Aeggeblomme, and Wonder of the World were the leaders of 100 varieties of potatoes tested at Reykjavik, while Mossrose, Helguhamms, Akureyrar, Maercker, and Bodopotet were first at Akureyri. Among the cereal varieties giving the best results were Grenau and Mesdag oats, and Early Svalöf and Bjorneby barley.

The structure of the cotton hair and its botanical aspects, H. J. DENHAM (*Brit. Cotton Indus. Research Assoc., Shirley Inst. Mem., 1 (1922), No. 4, pp. 87-100, figs. 11*).—A résumé of existing information on the structure of the cotton fiber, with parallel instances in the general botanical literature. With the possible exception of the pits in the fiber wall and the unusual length-diameter ratio of the fiber, no botanical abnormalities about cotton are apparent.

Handbook of spinning tests for cotton growers, W. L. BALLS (*London: Macmillan & Co., 1920, pp. 59*).—Designed for cotton growers desiring to obtain numerical statements of the intrinsic value of their product, this handbook points out the overlap of growing with spinning, analyzes the operation of cotton spinning, portrays the technique and defects of spinning tests, and treats of the interpretation of results.

[Experiments with flax in Canada], R. J. HUTCHINSON (*Canada Expt. Farms, Div. Econ. Fibre Prod. Interim Rpt., 1921, pp. 8, fig. 1*).—Observations on flax pulling and deseeding machinery, variety and scutching tests with fiber flax, manurial trials, and grading work are reported for the year ended March 31, 1921.

Fiber from flax grown on experimental farms in western British Columbia, Ontario, the St. Lawrence Valley, and the Maritime Provinces proved of first-class quality, comparing favorably with the best grades of Irish or Belgian fiber. Spinning tests showed Canadian fiber to be suitable for manufacturing the finest linen damasks. Binder twine made from seed-flax straw lacked uniformity, was too soft, and its average breaking point was not high. When flax was retted in concrete tanks, a temperature range of from 72 to 82° F. gave the quickest and best results. Tank-retted flax produced 7.5 per cent more of No. 1 grade fiber than dew-retted flax.

Pedigreed fiber flax, R. L. DAVIS (*U. S. Dept. Agr. Bul. 1092 (1922), pp. 23, figs. 9*).—Selection work to develop improved strains of fiber flax and to improve fiber-flax seed is reviewed; the technique of breeding flax by selection and hybridization, and the use of the score card to eliminate the poorer selections are explained; and devices for cross-pollinating and measuring flax are described.

Pedigreed strains, derived by eliminating all but the best types through several generations from the progeny of plants first selected in commercial flax fields in eastern Michigan in 1909, have showed themselves superior to commercial fiber flax. The supply of seed of the best pedigreed strains has

been increased by growing two crops in one year, the produce of fall plantings in Porto Rico and Alabama being resown in Michigan as a spring crop.

Grasses of British Guiana, A. S. HITCHCOCK (*U. S. Natl. Mus., Contrib. U. S. Natl. Herbarium*, 22 (1922), pt. 6, pp. X+439-515, pl. 1, figs. 10).—This account of the grasses of British Guiana contains a descriptive list of the species, keys to the tribes and genera, a discussion of the distribution of the species according to habitat, and notes on their economic uses. Ten new species are described.

The flora is related to that of Brazil and to that of the West Indies. A few montane species are found in the region of Mount Roraima, but most of the species are those of the tropical lowlands. The savanna grasses of the southern part of the colony furnish the basis of an important stock industry.

Labor requirements for harvesting hay in New Hampshire, H. C. WOODWORTH (*N. H. Col. Agr., Ext. Serv.*, 1922, pp. 13).—On 80 farms, 3,521 acres of hay yielding 4,119 tons were harvested with an average labor requirement of 10.4 hours per acre and 8.9 hours per ton.

Origin of false wild oats, R. J. GARBER (*Jour. Heredity*, 13 (1922), No. 1, pp. 40-48, figs. 4).—The occurrence of false wild oats in the cultivated varieties Victory, Garton 784, and Aurora is described in this contribution from the West Virginia Experiment Station. In a consideration of the origin of false wild oats, certain F_2 generations of *Avena fatua* \times *A. sativa* and *A. fatua* \times *A. orientalis* are discussed. From the evidence presented, it is thought that the origin of the aberrant forms may be attributed more logically to mutations than to natural crossing.

A study, by the crop survey method, of factors influencing the yield of potatoes, E. V. HAWDENBURG (*New York Cornell Sta. Mem.*, 57 (1922), pp. 1143-1279+[4], figs. 11).—Application of the survey method to a study of factors influencing potato yields was made in the potato growing areas of Suffolk, Nassau, Steuben, Monroe, Franklin, and Clinton Counties, New York, and the results were compared with experimental findings. The factors appearing to affect yield the most were also studied biometrically.

Climate, elevation, and soil as factors influencing yield were found to be so closely and inseparably related as to make difficult the determination of the influence of each. Available data showed that, although the climate for potatoes is generally best at the highest elevations, soil fertility is usually greatest at lower levels. In a blight year, farms at high elevations are likely to show the best yields, while in normal years the more fertile soils at the lower elevations may excel. The value of potato land as appraised by the growers was correlated with yield until the land was affected by real estate valuation.

Both biometrical and tabulation studies showed that of all the factors studied, amount of seed and value of manure and fertilizer per acre influenced yield the most. Next to these are depth of plowing, frequency of cultivation, and frequency of spraying. Factors of lesser influence on yield, as developed by the survey studies, include method of applying fertilizer, varietal type of potatoes, sun sprouting of seed, interval between cutting seed and planting, dusting cut seed, type of seed, system of planting, depth of planting, and system of cultivation. Other factors considered, not studied as to their influence on yield but which have a vital relation to production, comprise time of plowing, home mixing of fertilizer, analysis of fertilizer, use of lime, source of seed, chemical treatment of seed, dates and methods of planting and of harvesting, type of storage, and length of storage period.

While the study of crop production by the survey method showed the possibilities of this method, it can not apparently be substituted for either the

present carefully executed research of the State and Federal governments or more generally localized controlled experiments. The author believes, however, that the survey method can and should play a more prominent part in supplementing the present scope of research. A large number of records, preferably 400, for each region, with replication of the survey is suggested as the best and possibly only means of obviating seasonal conditions.

Report of the Potato Association of America (*Potato Assoc. Amer. Proc.*, 8 (1921), pp. 98, figs. 5).—A report of the eighth annual meeting of the association, held at Toronto in December, 1921, and outlining the activities of the organization during 1921. In addition to reports of committees on market standards and marketing, transportation, research, potato seed improvement and certification, varietal nomenclature and testing, judging standards, contests and exhibitions, and the relation of varietal type to yield, papers are included on *The Trend of Potato Research*, by E. V. Hardenburg; *Potato Breeding in Great Britain*, by J. W. Lesley; and *Seed Potato Improvement Work in the United States and Elsewhere*, by W. Stuart.

United States grades for potatoes, H. W. SAMSON (*U. S. Dept. Agr., Dept. Circ.* 238 (1922), pp. 4).—Further slight revisions, effective July 1, 1922, are made in the grades suggested previously (*E. S. R.*, 38, p. 34; 43, p. 335), and the grade U. S. No. 1 Small is added.

A study of the inheritance of beardedness of rice in natural hybrids, N. B. MENDIOLA (*Philippine Agr. Rev.*, 15 (1922), No. 1, pp. 28-43, pl. 1).—A study of natural rice hybrids appearing in Nagdami, an awnless variety, and Putyconan, an awned sort, is reported. Observations of several generations of the hybrids show that awning in these varieties is partially dominant over lack of awns. If more than one factor is responsible, probably not over two factors are involved in the production of awns. Line selection is indicated as the most efficient method for purifying a genetic mixture of bearded and beardless individuals.

Correlation of color characters in rice, G. P. HECTOR (*India Dept. Agr. Mem., Bot. Ser.*, 11 (1922), No. 7, pp. 153-183, pls. 2).—The inheritance of color characters due to soluble pigment in various parts of the growing rice plant, and of the color of the mature kernel and of the mature inner glumes, is discussed. See also an earlier note (*E. S. R.*, 38, p. 29).

The color in the leaf sheath, outer and inner glumes, apiculus, internodes, and stigma was found due to a single factor or to two, three, or four interacting factors. The genetic constitution of a color character in any one type is not held to be an index of its constitution in another type. "These color characters are frequently inherited in patterns of groups, due either to one and the same simple factor or to the same interacting factors; or due to several factors linked together. Considered in relation to other systems or patterns, independent segregation may take place, but frequently the groups are so interrelated that certain combinations, expected if independent segregation were taking place, are never found, and these combinations are those which are absent in pure-line cultures." While red color in the grain ordinarily segregates 3:1 in F_2 , and segregates independently of color in the vegetative parts, two cases are noted where the F_2 segregation was 1 red:2 pale red:1 white. In one of these, the color in the grain proved due to either the same factor responsible for color in the ligule, or to a factor completely linked therewith. Yellow-brown glumes were recessive to glumes ripening black, but dominant to those ripening red. Yellow glumes were also dominant over red. No connection was proved between the ripe glume colors and the colors in the vegetative parts.

United States grades for grain sorghums, H. J. BESLEY, E. G. BOEBNER, and B. E. ROTHGEB (*U. S. Dept. Agr. Dept. Circ. 245* (1922), pp. 8).—The grades and classes recommended by the U. S. Department of Agriculture for the grading and marketing of grain sorghums are outlined.

Studies of imported varieties of sugar cane, W. E. CROSS (*Rev. Indus. y Agr. Tucumán*, 12 (1921), No. 5-6, pp. 72-92, figs. 6).—Agronomic data, analyses, and the susceptibility to mosaic are given concerning varieties of sugar cane obtained from different world regions and tested at Tucumán.

Culture of sugar cane without burning the leaves and tops, W. E. CROSS (*Rev. Indus. y Agr. Tucumán*, 12 (1921-22), No. 7-8, pp. 103-110).—Practically equal yields of cane and sugar were obtained from plats of POJ 213 and POJ 228, whether the leaves and tops were left in the middles and worked into the soil or burned. Considerable benefits were exhibited by the soil receiving the unburned trash.

The culture of sugar cane with cowpeas between the rows, W. E. CROSS (*Rev. Indus. y Agr. Tucumán*, 12 (1921-22), No. 7-8, pp. 99-102, fig. 1).—Sugar cane at Tucumán without cowpeas gave average yields of cane and sugar slightly in excess of those produced by cane with cowpeas between the rows.

A study of cane left standing during two years, W. E. CROSS and S. DELASCIO (*Rev. Indus. y Agr. Tucumán*, 11 (1921), No. 7-8, pp. 85-98, figs. 5; *trans. in La. Planter*, 69 (1922), No. 5, pp. 74-76, figs. 2).—To solve the problem of excess production of sugar cane, POJ 36, 213, 234, and 228, all of which were eighth ratoons, and Kavangire, second ratoons, undamaged by frost and not flowering, were allowed to stand until the second year at Tucumán.

In general the purity of the cane kept practically constant during the whole second year. However, the concentration of the juice, in respect to both total solids and sucrose, decreased seriously during the summer months, being partially reestablished during autumn. Since the purity was constant, the cane evidently absorbed more water during the rainy season when vegetative development was resumed. The glucose also increased slightly because of the newly aroused vegetative activity, and the fiber content rose considerably, but not to such extent as to make impossible the economic milling of the cane. Analyses of POJ 36 with side shoots showed that although the juice of the side shoots was of lower purity than that of the cane itself, its purity and sugar content were not negligible, being much richer than those of the young stalks which grew from stubbles. The young canes which grew in the shade of the old canes did not generally have the rapid development of stubble cane and were slow to accumulate sugar, but by the middle of May they had obtained a fairly satisfactory sugar content.

Two-year cane was of greater purity than one-year cane up to about the beginning of April, when the new cane obtained an advantage which increased with the succeeding months. Samples of two-year-old cane from different parts of the Province confirmed the station results, indicating that up to the beginning of winter old cane was richer, but thereafter the new cane ripened rapidly, becoming increasingly richer than the two-year cane. The old cane, being of thick growth, twisted and fallen, and with side shoots, was somewhat difficult to harvest and cost more per ton for this operation than one-year cane. Laborers were induced with difficulty to cut the cane even at higher prices.

Tobacco in Ecuador, I. PAVIOLO (*Ecuador Dir. Gen. Agr. Bol. 4* (1921), pp. 35).—A brief account of the tobacco industry in Ecuador, with cultural and curing methods.

Hairy vetch, C. R. MEGEE (*Michigan Sta. Circ. 50* (1922), pp. 8, figs. 4).—Cultural practices suitable for hairy vetch production are outlined, with notes on the soil requirements of the crop.

Methods of winter wheat production at the Fort Hays Branch Station J. S. COLE and A. L. HALLSTED (*U. S. Dept. Agr. Bul. 1094 (1922)*, pp. 31, fig. 1).—Statistics show that while nearly three-fourths of the cultivated acreage in Ellis County, Kans., has been devoted to winter wheat, the average acre yield for the period 1891 to 1920, inclusive, was only 9.6 bu. The high proportion of wheat to other crops causes the preparation of wheat stubble for wheat to be the principal cultural problem in terms of acres involved.

During the 14-year period from 1907 to 1920, inclusive, wheat has been grown in cooperation with the Kansas Experiment Station at the Fort Hays Substation continuously after wheat by several methods of cultivation. Late plowing, 73 days after harvest and 17 days before seeding, averaged 10.5 bu. per acre, and early plowing, 32 days after harvest, 14.6 bu. Early plowing subsoiled averaged 17 bu., land listed instead of early plowed 17.3 bu., and land alternately fallowed and cropped to wheat 20.3 bu. From 1914 to 1920, inclusive, wheat sown in wheat stubble either disked or uncultivated averaged higher than late plowing and nearly as much as early plowing. Studies of the method of fallow and the length of the fallow season showed that cultivation did not increase the effectiveness of fallow for a longer period than the growing season of the fallow year.

Sod crops in rotations were found to be relatively unsuccessful. Alfalfa was better than brome grass, but had a very depressing effect upon following crops. Wheat after corn averaged about the same as the better methods of wheat after wheat. The depressing effect on wheat yields of kafir, which produced heavier yields of both grain and forage than corn, can be eliminated by a single year of fallow or cropping. Barley is indicated as a suitable crop between kafir and winter wheat in the rotation. Green manures, although more expensive, did not increase yields over bare fallow, or over early plowing of land from which a crop was harvested. Barnyard manure at different rates and in different positions in 3-year rotations of kafir, fallow, and winter wheat in the period from 1913 to 1920, inclusive, did not have a measurable effect upon the yields of either wheat or kafir.

The possibility of increasing the county average is shown. Land that can be early plowed or listed can not be fallowed profitably, although the acre yield might be increased somewhat; whereas land that can not be prepared early could be fallowed more profitably than plowed late and seeded. Land free from perennial weeds or grasses could be seeded in the stubble with greater profits, with no preparation unless perhaps a double-disking. The experiments suggest that the present average acre yield is not high enough. It is felt that the more completely the 90-day period between harvest and seeding is made a cultivation period the higher will yields rise above the present minimum.

Seed-testing notes: Perennial rye grass, N. R. FOY (*New Zeal. Jour. Agr.*, 24 (1922), No. 5, pp. 299–301, fig. 1).—Seed of perennial rye grass, tested for germination at the Biological Laboratory at Wellington, averaged 79 per cent for the 1921 crop and 75 per cent for the 1922 crop. In general, the North Island seed had a higher bushel weight than the South Island seed. The principal extraneous seeds were hair grass, goose grass, cat's-ear, sorrel, crested dogstail, rib grass, suckling clover, cocksfoot, white clover, and ergot sclerotia. "The presence of suckling clover and cat's-ear may be taken as being more or less indicative of New Zealand seed."

Fight the sow thistle, S. W. HOOPER (*N. Dak. Agr. Col. Ext. Circ. 42 (1922)*, pp. 32, figs. 13).—Attention is called to the rapid spread of the perennial sow thistle in northeastern North Dakota, and a report of progress in controlling the weed and experiences of farmers are given.

Sow thistle seems to thrive best in the heavy soil of the Red River Valley, and has gained the strongest foothold in the valley sections of North Dakota, Minnesota, and Manitoba. The experience of farmers shows that grain farming encourages the spread of sow thistle, making summer tillage necessary for the raising of crops maturing before the thistle produces seed. A system of live-stock farming or diversification which involves the raising of cultivated, feed, and pasture crops tends to control and check the spread of the weed. Long-time contracts or payment of the tenant for killing sow thistle are remedies suggested for rented land.

HORTICULTURE.

[Horticultural investigations at the North Dakota Station] (*North Dakota Sta. Bul. 159 (1922)*, pp. 28, 29, 30, 31, figs. 2).—Variety testing, as in earlier years (*E. S. R.*, 45, p. 235), comprised the greater part of the activities of the horticultural division during the year.

Of the 19 varieties of onions tested, Early Flat Red and Yellow Dutch were the earliest to mature, followed by Yellow Danvers and White Portugal, with Southport Red and Yellow and White Globes in close succession. Although transplanted greatly outyielded field-sown onions, the increase was not profitable except in the case of large sized varieties such as Prizetaker and Giant Gibraltar. Copenhagen Market, Henderson Succession, Enkhuizen Glory, Fottler Brunswick, Danish Ballhead, and Danish Roundhead cabbage varieties were found of superior value. A strain of Earliana tomato developed at the station gave, on account of its early maturity and symmetrical shape, general satisfaction throughout the State.

In tests with various small fruits, the Latham raspberry proved very satisfactory on account of productivity and hardiness. Because of adverse climatic conditions in the spring, only two strawberries, Dr. Burrill and Premier, produced satisfactory crops. The Euresco strawberry, despite protective mulching, was entirely killed out during the winter of 1920-21.

Because of high alkali content, the use of lignite ashes in greenhouse soils has proved deleterious to plant growth.

Report of the horticulture division, W. T. MACOUN (*Canada Expt. Farms, Hort. Div. Interim Rpt.*, 1921, pp. 42, figs. 7).—A general progress report for the year ended March 31, 1921.

Various apples and crab apples originated at the Central Experimental Farm and which have been found worthy of naming are technically described.

Studies of different materials for and methods of repairing wounds in fruit trees indicated that a mixture consisting of three parts of fine gravel and one part of cement was most satisfactory. It is advised that long vertical cavities are most effectively filled by placing the concrete in layers, between which are placed sheets of roofing paper. This separation allows for a certain freedom of movement in compliance with that of the tree, and prevents cracking of the concrete. Small cavities were satisfactorily filled with a single solid mass of concrete.

Satisfactory returns obtained from a Wealthy orchard planted in 1896 with trees spaced 10 by 10 ft. and managed under the sod mulch system lead the author to recommend this type of culture as satisfactory for certain northern sections where trees never attain large size. Studies, previously reported by Davis (*E. S. R.*, 46, p. 234), upon the heredity of yield in the apple are again reviewed.

Three recently named plums, Ottawa and Rideau of the *Prunus nigra* and Ekaro of the *P. americana* species are described. Several of the Hansen

hybrid plums are described in connection with notes on their behavior at Ottawa.

Four grapes, Craig, Mary, Wilkins, and Lincoln, are described with notes on their origin. Notes on the performance of several vinifera grapes indicate that with laying down and covering in winter a few varieties are able to produce satisfactory crops of ripe fruit. The Pearl of Csaba, a Hungarian variety, has proved the most satisfactory.

In addition to tabulated data on yield, several black currants and gooseberries originated by the late W. Saunders are described. A three years' study of the effect of overhead irrigation on the yield of strawberries growing in a light sandy soil indicated that under the conditions obtaining irrigation is unprofitable. The value of winter mulching for strawberries was shown in the spring of 1920, when mulched plants outyielded the unmulched by approximately 244 per cent. Varietal data are presented for several strawberries with reference to yield, season of maturity, etc. A list is presented of various fruits recommended for eastern and central Ontario south of latitude 46°.

Sweet corn breeding, continued with a view to developing higher quality varieties suitable for the cooler sections of Canada, has produced three varieties, Pickaninny (a very early black sort), Early Malcolm, and Sweet Squaw. The Alacrity tomato, a variety originated at the Central Experimental Farm, is recommended on account of its early maturity. In studies in the production of celery seed, difficulty was met in wintering parent plants, outdoor storage falling in three years out of four. Better success was attained in a root cellar, where in 1920-21 895 out of a total of 1,500 plants lived through the winter.

Greenhouse studies comparing head lettuces with Grand Rapids loose leaf lettuce indicated that the Early Paris heading variety could be grown satisfactorily under the same environmental conditions as Grand Rapids. Davis Perfect and Rennles XXX cucumbers gave practically equal yields of marketable fruits.

Data are presented on the value of many different plants for hedge purposes and on desirable varieties of iris, peony, and phlox as determined in tests in the gardens at Ottawa.

Celery culture for Utah, T. H. ABELL (*Utah Sta. Circ.* 47 (1922), pp. 3-23, figs. 4).—A presentation of general information relative to celery production in Utah, in which are considered soils, fertilizers, preparation of the soil, plant production, methods of planting, irrigation, cultivation, blanching methods, harvesting, storage, diseases, and the importance of good seed. The existence of a distinct strain, Utah, thought to be a sport from the Giant Pascal variety, is noted.

Tomato breeding, J. BECKER (*Gartenwelt*, 26 (1922), No. 30, pp. 312-315).—A technical discussion of the principles of plant breeding as applied to the tomato, in which it is pointed out that, with proper understanding of the segregation of characters according to Mendel's law, any desired type of tomato may be evolved without resorting to chance.

The present status of orchard fertilization, F. C. BRADFORD (*Kans. State Hort. Soc. Bien. Rpt.*, 36 (1920-21), pp. 126-129).—A critical survey of the experimental evidence obtained in orchard fertilizer studies in various States. It is pointed out that of the three major plant foods, nitrogen, phosphorus, and potassium, nitrogen is the only one to have shown profit in apple fertilization. The author discusses the effect of nitrogen on the apple tree and makes suggestions relative to its proper use.

Orchard experiments: Trials with stocks at Yanco Experiment Farm, W. J. ALLEN and J. M. ARTHUR (*Agr. Gaz. N. S. Wales, 33 (1922), No. 5, pp. 347, 348*).—Observations on the growth of d'Agen prunes budded in 1917 on four different rootstocks, namely, peach, apricot, and Mariana and Myrobalan plums, indicated that the trees on Mariana and apricot were making the best progress. Those on peach were of good size but lacked in fruiting laterals. The trees on Myrobalan roots were comparatively weak.

The test was enlarged in 1918 by budding Oregon Silver, Robe de Sergeant, and Clairac Mammoth prunes and Angellina and President plums on the four different stocks. Robe de Sergeant and Clairac Mammoth showed a distinct preference for Mariana and apricot roots. It is believed that the present poor development on Myrobalan roots is a temporary condition, since older trees planted in 1908 are now making a satisfactory growth on the same rootstock. Plums worked on Mariana bear heavily at an earlier age than those on other stocks, with a consequent reduction in vegetative development. This smaller size is considered to be a desirable asset in that the fruit is more easily harvested.

Cold storage as an aid to the marketing of plums.—A progress report, E. L. OVERHOLSER (*California Sta. Bul. 344 (1922), pp. 427-463, figs. 11*).—Subsequent to a preliminary discussion relative to the extent and importance of the California plum-producing industry and the comparative value of different varieties, data are presented upon an investigation begun in the summer of 1918 and carried on through 1919 and 1921, in which plums of different varieties harvested at the University Farm were shipped immediately to Berkeley and there placed in cold storage to determine their keeping capacities. Samples removed from storage at intervals of from 7 to 10 days were tested after exposure for 3 or 4 days in a warm environment for general condition, degree of maturity, juiciness, texture, flavor, quality, and the amount of wilting and decay.

The data, presented for the most part in tabular form, show that three varieties, Kelsey, Grand Duke, and Wickson, kept latest and behaved most satisfactorily in cold storage. In grouping other varieties according to their keeping quality, the Satsuma, Agen, Yellow Egg, and Tragedy are described as very good keeping plums; the Imperial, German Prune, Pond, Robe de Sergeant, Climax, Sultan, and Sugar as moderately good keeping; and the Beauty, Botan, Abundance, Burbank, Combination, Clyman, Peach, Washington, and Columbia as inferior keeping plums. The Climax and Tragedy were excellent in respect to quality developed in storage as compared with the Combination, Peach, Botan, Columbia, and German Prune, all of inferior quality.

Although 32° F. was apparently the most desirable storage temperature, certain varieties, such as Kelsey, Wickson, Agen, Grand Duke, Satsuma, Yellow Egg, Pond, Climax, Tragedy, Robe de Sergeant, and Beauty kept well at 36°, indicating that these varieties could be transported in refrigerator vessels to the eastern markets via the Panama Canal.

Studies of plum prices and shipments on the New York markets, presented in diagrammatic form, indicate a definite correlation between low prices and large shipments, leading the author to suggest that certain of the better keeping varieties might be profitably held in storage during the period of heavy supplies. Records taken of the amount of fruit of different plum varieties received in the New York markets in 1920 indicate that, in the order named, Kelsey, Pond, Wickson, Tragedy, Giant, Grand Duke, Diamond, Burbank, and Climax were the most abundant.

In concluding, the author recommends that increased attention be paid to the manner of picking, grading, packing, and handling fruit, and suggests that

plums are frequently harvested when too green to allow for full development of color, size, and flavor.

The frutilla, or Chilean strawberry, W. POPENOE (*Jour. Heredity*, 12 (1921), No. 10, pp. 457-466, figs. 5).—An illustrated account presenting historical, geographical, and cultural notes concerning the Chilean strawberry, *Fragaria chilensis*, with particular attention to present day strawberry production in South America. At Guachi, Ecuador, where the elevation is approximately 10,000 ft. and the temperature rarely rises above 70° F., fruit is harvested once a week throughout the entire year. There are, however, three especially productive seasons, February, August, and December. The berries are large and exceedingly firm, standing rough shipment without serious injury. In Chile and Peru, on the other hand, only one crop is obtained, leading the author to presume that continuous fruition is due to environmental factors, there being an almost complete absence of well-defined seasons at Guachi.

Some common errors in vine pruning and their remedies, F. T. BIOLETTI (*California Sta. Circ.* 248 (1922), pp. 8, figs. 6) —A circular of general information relating to the pruning of vinifera grape varieties. The author, through the media of illustration and discussion, points out certain general principles which are believed to underlie successful growth and production and shows how departure from these principles may seriously injure the vines and cut down yields. The principles as outlined are "(1) each year the vine bears a crop and develops the buds which produce the crop and growth of the following year, (2) the condition of a vine at the end of a year determines how much crop it can bear and how much growth it can make the next year, and (3) the more crop a vine bears in one year the less growth it can make in the same year, and vice versa."

Replacing missing vines, F. T. BIOLETTI (*California Sta. Circ.* 249 (1922), pp. 4, figs. 3).—Observations on the yield of 5-year-old Muscat and 7-year-old Sultanina vines situated next to vacancies caused by the death of individual plants showed respective increases of approximately 20 and 43 per cent in yield, as compared with the average of the row. The net loss per acre, despite this compensating yield, is computed to be 960 lbs. for every 10 per cent of missing vines in plantings of the Muscat variety and about 680 lbs. for Sultanina under the same conditions. A method of layering applicable to Emperor grapes grown on the cordon system is outlined, whereby replacement may be secured with the least possible delay.

Status of California grape industry, June 30, 1922, R. L. NOUGARET (*Calif. Dept. Agr. Spec. Pub.* 28 (1922), pp. 47, pl. 1).—Similar to that of the preceding period (*E. S. R.*, 46, p. 40), this paper reports a survey of the grape industry in California, presents data relative to production of grapes and grape products, discusses transportation difficulties and other problems, supplies information relative to new acreage planted in 1922 and relative to the importation of grapes, raisins, and wines from foreign countries, etc.

Export of grapes: Results of experimental shipments (*Union So. Africa Dept. Agr. Jour.*, 5 (1922), No. 3, pp. 231-233).—Brief comments are given on the condition on arrival in London of 27 vinifera grape varieties shipped from the Paarl Viticultural Experiment Station, Cape Colony, South Africa.

Olive culture in Tunis, J. A. TOURNIEROUX (*Dir. Gén. Agr., Com., et Colon. [Tunis]*, Bul., 26 (1922), No. 109, pp. 129-368, figs. 74).—This is a general account relating to the olive-growing industry in Tunis.

Investigations in avocado breeding, B. S. NIRODY (*Calif. Avocado Assoc. Ann. Rpt.*, 1921-1922, pp. 65-78, figs. 4).—Three groups of cultivated avocados,

(1) West Indian, (2) Guatemalan, and (3) Mexican, are discussed in respect to their desirable and undesirable features and the better varieties in each group. Suggestions are made relative to desirable combinations of parent varieties, and information is presented relative to the technique of pollination, the season of bloom of many varieties, and the varieties suitable for interplanting.

Citrus rootstock problems, H. J. WEBBER (*Calif. Citrogr.*, 7 (1922), No. 12, pp. 391, 408-411, figs. 7).—In pointing out the variations that exist in size, vigor, and productivity in trees of a single citrus variety, the author suggests that propagation upon unselected seedling rootstocks is probably the chief contributing cause. Previously noted experiments (E. S. R., 42, p. 140) with citrus stocks assorted according to size are cited.

Further evidence of the effect of the size of the nursery tree upon the development of the orchard was found in a 60-acre commercial grove near Pasadena, where, in planting, the largest sized trees were utilized first, then the medium sized, and finally the small, inferior trees. Examinations five years later revealed remarkable variations in accordance with the size of the trees at the time of setting. That portion of the grove planted with large trees consisted of large, uniform, fruitful individuals. In the portion set with intermediate sized nursery trees the individuals were much smaller, none of them being as large as the smallest trees in the first block. That portion set with the small nursery trees was decidedly inferior, the individuals being small, variable in size, and making an unsatisfactory growth. In a discussion of various possible causes, the author believes that multiplicity in the type of rootstocks is the most probable source of variability.

Examination of 7-year-old trees budded from selected types of sour and sweet orange stocks showed a remarkable variation in respect to size, foliage, fruit, and flowers. Known instances of the effect of stock on scion are cited to show that stocks influence the size of tree, time of bearing, hardiness of tree, etc. Practical suggestions are made for the immediate improvement of the citrus industry by the selection of better parent types and the rigorous culling of young stock in the nursery.

Figs, B. E. DAHLGREN (*Field Mus. Nat. Hist. [Chicago], Dept. Bot. Leaflet 1 (1922), pp. 7, pl. 1*).—A brief popular article relative to the botany, distribution, and manner of pollination of the fig.

The coco palm, B. E. DAHLGREN (*Field Mus. Nat. Hist. [Chicago], Dept. Bot. Leaflet 2 (1922), pp. 7, pls. 2*).—A popular paper relating to the manner of dispersal, botany of the tree, and the economic uses of the fruit, leaves, and wood of the coconut palm.

Hardy perennials, A. J. MACSELF (*London: Thornton Butterworth, Ltd., 1922, pp. 219, pls. 8, figs. 24*).—A general treatise relating to various species, their propagation, cultural requirements, and proper utilization.

The rose encyclopedia, T. G. W. HENSLOW (*London: Vickery, Kyrle & Co., Ltd., 1922, pp. XXI+441+XXIV-XXVI, pls. 51, figs. 54*).—A compilation of general information pertaining to rose varieties and rose culture.

FORESTRY.

Humus and root systems in certain northeastern forests in relation to reproduction and competition, B. MOORE (*Jour. Forestry, 20 (1922), No. 3, pp. 233-254*).—Further information (E. S. R., 37, p. 651) is presented in this paper relative to the factors influencing reproduction of conifers in New England. The investigation was conducted on Mount Desert Island, Me., where,

on account of the irregularities of the contour there exists a diversity of sites, the predominant ones being of granite rock and bowlder till, with patches of gravel and clay interspersed. The mineral soil, naturally infertile, is covered with a blanket of poorly disintegrated and very acid humus, which, however, is the main reliance of the forest trees for sustenance and, except in the hardwood type, contains at least 90 per cent of the feeding roots of all the trees. The moisture content of the humus beneath spruce was found to be 20.5 per cent as compared with 59 per cent for humus in the open areas, which discrepancy is accounted for not only by the vast number of absorbing rootlets but also by the covering of needles which serve as a blanket and tend to prevent the penetration of water.

Studies of the root development of young white pine, red spruce, balsam, fir, and white cedar showed that in most cases the roots do not penetrate the gravelly soil. In the instance of white pine it was observed that the main root, failing to penetrate the mineral soil, in many cases turned and remained entirely in the humus or between it and the mineral subsoil. Balsam fir seedlings usually developed strong main roots with slightly branched laterals in the humus layer. Red spruce and white cedar seedlings were found to root for the most part in the humus layer with an occasional main root entering the mineral soil. Sugar maple roots, on the other hand, were able to force their way to a considerable depth into the lower soil, at the same time sending a great many side branches into the humus.

A study of the age of the trees in a mixed stand of conifers showed marked periodicity in reproduction, it being evident that the different species had distinct years of maximum reproduction. Mycorrhizal fungi of *Cortinarius* were found on the roots of spruce, fir, and white pine.

History of forest development on an undrained sand plain in the Adirondacks. W. L. BRAY (*N. Y. State Col. Forestry, Syracuse Univ., Tech. Pub. 13 (1921), pp. 47, pls. 14*).—As indicated in an earlier paper (*E. S. R.*, 35, p. 146), irregularities in the topography of the Adirondack Forest area have led to the development of many different vegetative types. One of these, the bog type occurring on poorly drained low areas, is discussed in detail in this paper, which reports a study of the Grasse River Marsh area, a broad, poorly drained sand plain covered for the greater part with a layer of peat, which at the present time is occupied by a vegetative complex in which sphagnum is the controlling element. The occurrence of a series of plant associations ranging from open sphagnum-sedge meadow to the initial stages of a balsam swamp forest is believed to suggest a general tendency to change from bog to forest. It is thought that the black spruce-tamarack-arborvitae bog forest, although persistent and in effect an edaphic climax association, nevertheless promotes soil conditions which introduce balsam and its swamp forest associates and may ultimately go over definitely into a balsam swamp forest.

Vegetative reproduction, found to be almost universal among bog plants, assists materially in the expansion of shrub colonies and accounts for their spotty occurrence. The dominance of black spruce in bog forests is accounted for by its ability to reproduce from layers.

It is suggested that studies of this nature may assist in the elaboration of a forest policy, in that they show not only a tendency for vegetation development to culminate in forests but also in that they indicate how closely this development is associated with soil conditions such as drainage, etc.

Branch orders and tolerance. F. L. DuMOND (*Jour. Forestry, 20 (1922), No. 5, pp. 448-462*).—Observations on 22 important forest tree species of Connecticut failed to show any correlation between the number of branch orders

and tolerance to light, as had been suggested by Wiesner (E. S. R., 19, p. 930). With the exception of scarlet oak, black birch, and shagbark hickory, the highest average number of branch orders occurred in the lower portion of the crown, and the lowest number was found in the upper crown. In the oak, birch, and hickory above noted the maximum number of branch orders was found in the middle crown.

In classifying the individual trees of a species according to the quality of the site, it was found in general that those trees occurring on the more fertile soils had a greater average maximum number of branch orders. A general tendency was found for the number of branch orders to increase as the trees increased in diameter. Trees standing in the open were observed to have a higher number of branch orders than did those in dense stands. A study of the relation between the diameter of the ultimate twig, area of the leaf surface, and the average maximum number of branch orders showed that in general those species such as tulip, ash, and hickory which have large twigs have few branch orders.

In concluding, the author states that the number of branch orders can not be taken as an accurate index of light tolerance because of the great number of conflicting factors which may influence the development of branches. Furthermore, the narrow range, from 3 to 8, between the lower and upper limits of the number of orders contributes to prevent their use as a key to light tolerance.

Notes on the Douglas fir, P. LESLIE (*Roy. Scot. Arbor. Soc. Trans., 36 (1922), pt. 1, pp. 13-34, pls. 4*).—On the basis of information obtained during an inspection and collection trip in western North America, the author, in line with an earlier paper by Henry and Flood (E. S. R., 44, p. 742), discusses the variations existing in the Douglas fir (*Pseudotsuga douglasii*). Three distinct types, namely, (1) the dry belt form, *glauca* variety, (2) the mountain form, *cacsia* variety, and (3) the coast form, are described in connection with notes relative to range, elevation, moisture relations, shape and size of cones, characteristics of seedlings, etc.

Trees and shrubs of Mexico (Fagaceae-Fabaceae), P. C. STANDLEY (*U. S. Natl. Mus., Contrib. U. S. Natl. Herbarium, 23 (1922), pt. 2, pp. 171-515+XXXVII*).—This second installment of a previously noted work (E. S. R., 44, p. 40) includes brief technical descriptive notes and data relative to habitat, economic uses, etc.

State forestry laws of 1921, J. S. PEYTON (*U. S. Dept. Agr., Dept. Circ. 239 (1922), pp. 28*).—Following a brief introductory statement, in which the author outlines and discusses certain legislative features which should be considered by all the States containing considerable forest areas, summaries are presented of the most important provisions of the State forestry laws of 1921.

The administrative report of the Virginia State forester for the calendar years 1920-1921, with suggestions for extensions of State forestry work, and recommendations for amendments to the present forestry laws, C. JONES (*Va. State Forester Rpt. 1920-1921, pp. 63, pl. 1, fig. 1*).—The usual biennial report (E. S. R., 42, p. 839) relating to forest protection, forest nurseries, assistance rendered private owners, etc. The accession by donation of a forest area including 588 acres in Prince Edward County is noted. The text of forestry laws as in effect January 1, 1922, is appended.

Report of the commissioner of Dominion parks for the year ending March 31, 1921, J. B. HARKIN ET AL. (*Canada Dept. Int., Rpt. Commr. Parks, 1921, pp. 70, figs. 17*).—This is the usual annual report, devoted for the greater part to administrative activities.

DISEASES OF PLANTS.

[Plant disease investigations at the North Dakota Station] (*North Dakota Sta. Bul. 159 (1922)*, pp. 20-22, 23, 24).—Notes are given of a number of plant disease investigations in progress at the station.

Wheat scab was found rather abundant in wheat fields in 1920 that had been previously in corn. The disease was more serious in 1919, when all varieties investigated had scabbed heads. Certain varieties, which are mentioned, appear to be especially subject to this disease. The scab is said to attack cereals by destroying the germination of infected seeds, and through infection at blossoming time, bringing about head blighting. For the control of scab careful cleaning of seed, treating the seed grain with formaldehyde, and avoiding planting wheat in fields occupied by corn the previous season are recommended. Scabbed wheat stored for 5 years in the laboratory was found to contain the scab organism in a viable condition.

In investigations of the *Helminthosporium* blight of wheat, it was found that only about one-half of the black-pointed grains were infected with the organism. Among the durum wheats the highly rust-resistant varieties appear to have a larger proportion of black points than the others.

A brief statement is given regarding black stem rust of wheat and barberry eradication, in which it is reported that about 11,546 square miles of the State have been surveyed and the barberry bushes removed. About 4,000 square miles of an earlier survey will have to be resurveyed as some bushes have been found in the area. As indicating the existence of different forms of stem rust, it is reported that several varieties of wheat at Fargo showing 40 per cent and less of infection were affected to the extent of 75 per cent at the Minnesota Station, while at the Nebraska Station the same varieties were affected to a much less degree.

Notes are given of some flax diseases, attention being called to flax canker, or breaking off, which seems to be associated with high soil temperatures when the plants are only a few inches high. Wilt resistance is briefly reported upon, and it is claimed that 5 varieties with an average resistance of 57 per cent were increased to an average of 73 per cent by growing them one year on infected soil. Of 178 samples of seed from different known sources, less than one-half proved more than 10 per cent resistant to wilt. It has been found practicable to determine resistance of flax to wilt by growing plants during the winter in the greenhouse for six weeks. Some observations are reported of investigations on the organism causing flax wilt, and it has been found that both the flax and the wilt fungus readily grow in the same media.

Potato disease studies are reported upon, the work centering around the control of scab, *Rhizoctonia*, and wilt or stem-end rot through selection and treatment. Sixty-six samples of seed potatoes were submitted for certification, and only 37.7 per cent were found free from scab, 24.2 per cent free from *Rhizoctonia*, and 13.6 per cent free from *Fusarium* wilt. Laboratory investigations are said to have shown that ring discoloration increases during storage.

Mycology [*Nigeria, 1920*], T. LAYCOCK (*South. Provs., Nigeria, Agr. Dept., Ann. Rpt., 1920-21, pp. 23-25*).—The tikka disease (*Cercospora personata*) of peanut was very virulent during the season. Two varieties (Ayaya and Matche Atsgune) showed resistance and sustained yielding capacity.

Coconut bud rot, though prevalent in sections named where both cultural conditions and environment were very unfavorable, was absent where good management and favorable natural conditions prevailed. The demonstration regarding the exclusive causal agency of *Bacillus coli communis* has not yet been obtained.

A tabulated showing is made of *Hevea* diseases affecting the root, stem, and tapped surface in the various districts. These troubles include white root (*Polyporus lignosus*), brown root (*Hymenochacte noxia*), collar rot (*Ustilina zonata*), wet root rot (*Fomes pseudoferreus*), pink disease (*Corticium salmonicolor*), brown bast (cause unknown), white thread blight (*Cyphella heveae*), fruit patch canker (*Phytophthora faberi*), moldy rot (*Sphaeronema* sp.), and black stripe (*Phytophthora* sp.).

An oil palm disease (*Ganoderma lucidans*) appeared in one locality.

Cacao tree diseases arise almost solely through improper cultivation, pruning, spacing, or other mismanagement, such as leaving diseased material near the trees. Fungi noted in this connection include *P. faberi*, *Diplodia cacaoicola*, *H. noxia*, and *Polyporus lignosus*.

Cotton diseases noted include rust (*Kuehneola desmum*) and gray mildew (*Ramularia areola*). Yams show *Bagnisiopsis dioscoreae*, previously reported as occurring in the Oban and Okigwi districts.

A study of the environmental conditions influencing the development of stem rust in the absence of an alternate host.—I, The viability of the urediniospores of *Puccinia graminis tritici* Form III, G. L. PELTIER (*Nebraska Sta. Research Bul.* 22 (1922), pp. 3-15, figs. 3).—As having a possible bearing on the overwintering of the stem rust of wheat, the author conducted a series of experiments in which germination and infection tests were made of a culture of *P. graminis tritici*, Form III, received from the Minnesota Experiment Station. By means of constant temperature and humidity control the effect of these factors was determined on both the germination of the urediniospores and their ability to infect wheat seedlings. Temperatures of from 5 to 30° C. and humidities varying from 0 to 100 per cent were maintained.

High relative humidity, especially if accompanied by high temperature, was found detrimental to germination and infection. At low temperatures and medium relative humidity, the viability of the spores was greatly prolonged, the spores remaining viable and capable of infecting wheat seedlings after 16 weeks at a temperature of 5°, with the relative humidity ranging from 38 to 70 per cent.

The highest percentage of germination and the longest viable period of the spores were found to occur at the medium relative humidities. High temperatures lowered the percentage of germination and shortened the viable period, while low temperatures at medium relative humidities had an opposite effect. The investigations are believed to show that down to certain temperatures the urediniospores are viable for long periods of time at the prevailing relative humidities encountered in the field in the fall in the winter wheat belt. It was further indicated that at constant temperatures below the mean temperatures prevailing during the summer months in the South the urediniospores are not viable for any great length of time.

Biologic forms of wheat stem rust in western Canada, M. NEWTON (*West. Canad. Soc. Agron. Proc.*, 1 (1920), No. 1, pp. 34, 35).—The author claims to have shown by infection experiments that at least 11 distinct biologic forms of wheat stem rust were present in the great grain-growing districts of western Canada, whereas only one form was known to exist before 1916.

All the strains so far isolated in Canada have been described in the United States. In some districts two strains were found as shown by infection studies. A rather virulent strain was found to be widely distributed.

Transference of the bean mosaic virus by *Macrosiphum solanifolii*, R. NELSON (*Science*, 56 (1922), No. 1447, pp. 342-344).—Field observations in 1921 and the sudden appearance of mosaic on beans in the greenhouse in May, 1922, led to experiments under control conditions that gave direct proof of

the transfer of the virus of bean mosaic by *M. solanifolii* under field and greenhouse conditions.

Cabbage wilt and stem rot in Delaware, T. F. MANNS (*Delaware Sta. Bul.* 192 (1922), pp. 3-24, fig. 13).—Attention is called to losses due to cabbage wilt or yellows caused by *Fusarium* sp. and to stem rot which is caused by *Phoma* sp. The results of preliminary tests of strains of cabbage for resistance to wilt and stem rot are given, and experiments initiated to secure wilt-resistant varieties are described. For the prevention of cabbage wilt and stem rot, seed treatment, seed bed rotation, and proper field rotation are recommended. The wilt-resistant strains developed in Wisconsin (E. S. R., 45, p. 243) have not proved to be adapted to conditions in Delaware.

A preliminary report on a study of various clovers as found on three soil experiment fields of Kentucky, with special reference to root systems, E. N. FERGUS and W. D. VALLEAU (*Abstr. in Science*, 56 (1922), No. 1438, p. 86).—An ecological and pathological study of various clovers growing in three soil types of Kentucky has been made in order to determine, if possible, the causes of clover failure. Counts showed that red and alsike clover stands were practically equal throughout the first year whether on productive or clover sick soils. A diminution of stands occurs on most soils during the second summer, reaching 100 per cent on the least productive soil. Root rot was present to some extent on all roots examined. Those developed in the least productive soils were badly diseased or dead at the end of the first season. All taproot systems examined were badly diseased or dead at the end of the second season, and the persistence of the clover plant after the death of the taproot systems was found to depend on its ability to produce new roots from the crown.

Some seed-borne diseases of agricultural crops, W. D. VALLEAU (*Abstr. in Science*, 56 (1922), No. 1438, p. 86).—Studies on the extent of seed infection of corn with *Fusarium moniliforme* are said to have shown that it is practically universal. The organism is carried between the various seed coat layers and may extend in as far as the aleurone layer. In very flinty corn the organism remains dormant a longer period after seed is planted than in poorly filled starchy kernels.

A preliminary study of 8 lots of barley received from 3 States, 12 lots of oats from 4 States, and 38 varieties of wheat from 5 States indicated that small grains are infected to a high degree with pathogenic organisms. Morphological studies of lettuce seeds are said to have shown the presence of an organism in a high percentage of seeds which is believed to be the causal organism of lettuce root rot. Tests of clovers suggested that the causal organism of root rot is constantly present in the clover seed.

Bacterial spot of cucumbers, F. C. MEIER and G. K. K. LINK (*U. S. Dept. Agr., Dept. Circ.* 234 (1922), pp. 5, pl. 1).—A description is given of the bacterial spot of cucumbers due to *Bacterium lachrymans*. For the control of this disease seed disinfection is recommended. If the angular leaf spot appears spraying with a 4-4-50 Bordeaux mixture will prevent its spread.

Investigations on flax diseases, G. H. PETHYBRIDGE, H. A. LAFFERTY, and J. G. RHYNEHART (*Ireland Dept. Agr. and Tech. Instr. Jour.*, 21 (1921), No. 2, pp. 167-187, pls. 6).—The investigations reported on previously by Pethybridge and Lafferty (E. S. R., 46, p. 743) were continued during the summer and the winter. The present report supplies further information on these, and also deals with a few other troubles which have now been brought to light.

Special attention was directed to seedling blight (*Colletotrichum ulnicolum*), browning and stem break (*Polyspora lini* n. g. and n. sp.), rust and firing (*Melampsora lini*), foot rot (*Phoma* sp.), wilt (*Fusarium lini*), Botrytis dis-

ease (*Botrytis* sp.), Sclerotium disease (*Sclerotinia sclerotiorum*), and yellowing, besides injury due to dodder (*Ouscuta epilinum*) and to insects named.

The wilt disease of indigo in Bihar. A. and G. L. C. HOWARD ET AL. (*India Dept. Agr. Mem., Bot. Ser., 11* (1920), No. 1, pp. 1-26, pls. 5, figs. 5).—The relevant facts obtainable under the conditions existing tend to indicate that indigo wilt results from the destruction of the fine roots and the nodules under circumstances which make regeneration difficult or impossible. Such destruction occurs following the first cut. Good soil aeration will often give an excellent second crop. Waterlogging of the soil hinders regeneration of the deeper roots but favors development of surface roots which suffer from lack of water as the ground dries after the monsoon, and the coming of cold weather hinders the formation of new roots.

Studies in diseases of the jute plant.—I, *Diplodia corchori*, F. J. F. SHAW (*India Dept. Agr. Mem., Bot. Ser., 11* (1921), No. 2, pp. 37-58, pls. 11).—A review of the trouble for which the name jute black band disease has been proposed shows it to exist in Bihar, Assam, and Bengal, being well diffused over the whole jute-bearing area. The incidence of the disease appears to be in some way connected with the attainment of a certain size.

The causal organism (*D. corchori*) occurs after flowering and threatens the seed crop. Intensity varies greatly from one season to another. It is most severe on large, well-grown stems, and infection occurs more readily on green stemmed than on red stemmed varieties. Further studies are needed to show the mode and conditions of infection.

Results of four years' cooperative experiments with (dry) formaldehyde for the prevention of oat smut. J. E. HOWITT (*Ontario Dept. Agr., Ann. Rpt. Agr. and Expt. Union, 43* (1921), pp. 27-30).—The loss due to oat smut in Ontario is thought to approximate \$3,000,000 annually, practically all of which is considered preventable. In order to demonstrate the effectiveness of the dry formaldehyde seed treatment, cooperative experiments were conducted during the past 4 years. In all, 35 field trials were made, involving the treatment of 2,122 bu. of oats of the varieties O. A. C. No. 72, Alaska, Banner, White Cluster, Mammoth Cluster, and Siberian.

The average for the 4 years during which the tests were continued shows no smut in crop from treated seed as against 4.23 per cent of smut from untreated seed. Tests regarding seed vitality showed no injury due to the treatment. The results have thus been uniformly satisfactory throughout the experiments.

A new disease of *Pennisetum typhoideum*. M. MITRA (*India Dept. Agr. Mem., Bot. Ser., 11* (1921), No. 3, pp. 57-74, pls. 4, fig. 1).—A disease causing spots on ears, leaves, and leaf sheaths of *P. typhoideum* appears to be due to a fungus which is considered a new species, and which has been named *Acrothecium penniseti*.

Infection may occur through a stoma, or an unwounded epidermal cell may be pierced by the fungus which is both inter- and intracellular in habit.

Cross inoculations on male inflorescence of maize were successful, those on sorghums giving negative results.

Potato common scab investigations [in Canada]. F. L. DRAYTON (*Canada Expt. Farms, Div. Bot. Interim Rpt., 1921, pp. 16-18*).—In 16 samples of 23 taken from potato soils in various parts of Canada, the isolation of *Actinomyces scabies* was easily successful. The six soils showing no *Actinomyces* were all found to be of measurably higher H-ion concentration than were those in which this organism was found, and were principally peat or mixtures of peat and clay. From 250 or more isolations obtained from soils or scabby tubers, 35 distinct types were differentiated by the use of Czapek's agar and were chosen

for further study. The H-ion concentration is suspected to be a significant factor in potato scab.

The crown rot of rhubarb caused by *Phytophthora cactorum*, W. S. BEACH (*Pennsylvania Sta. Bul.* 174 (1922), pp. 28, figs. 25).—In a previous publication (E. S. R., 47, p. 445) attention was called to a crown rot of rhubarb found in Philadelphia County, Pa. Subsequent investigations have shown that the disease in question is due to *P. cactorum*. The characteristics of the disease, its distribution, relation to environment, etc. are described at length. For the control of the disease, the author advises that plants from infested fields should not be used to establish new fields, but that stock should be started from seed under disease-free conditions or taken from an old, healthy field. Spraying with Bordeaux mixture has been found an effective method of preventing the spread of the disease in summer, but it will not prevent the decay of plants which have become infected. Roguing and destroying infected plants early in the season and the disinfection of dormant roots are recommended.

In the second part of the bulletin symptoms of the disease due to *P. cactorum* are contrasted with somewhat similar diseases occurring elsewhere

Bacterial pustule of soy bean, F. HEDGES (*Science*, 56 (1922), No. 1439, pp. 111, 112).—A preliminary account is given of a disease of soy beans to which the name bacterial pustule is given. The disease is due to a yellow organism first isolated by the author from soy bean leaves grown in Texas in 1917. The organism is given the name *Bacterium phaseoli sojense* from its close relation to *B. phaseoli*, the cause of bacterial bean blight. Comparisons were made between this organism and *B. glycineum*, the cause of a bacterial blight of the soy bean (E. S. R., 42, p. 352), and the two diseases are said to resemble each other very closely in the later stages of their development.

Further studies on control of sugar beet nematodes through a modification of the catch crop method, H. C. MÜLLER and E. MOLZ (*Landw. Jahrb.*, 54 (1920), No. 5, pp. 747-768).—The procedure instituted by Kühn (E. S. R., 22, p. 249) of employing catch crops to remove nematodes was successfully modified in ways described, principally by destroying the catch crops with iron sulphate at concentrations of about 30 per cent and allowing a second catch crop to grow, removing the nematodes remaining after the first treatment.

Sugar cane root disease, F. S. EARLE (*Porto Rico Dept. Agr. Jour.*, 4 (1920), No. 1, pp. 3-27).—Root disease, as here dealt with, appears to be a complex including phases often known as root rot, withertip, top rot, and rind disease, phenomena caused by different facultative parasites, but none of which attack vigorous, actively growing tissues. *Rhizoctonia* and *Pythium* are the usual root killing fungi rather than *Marasmius* and *Himantia*. There is also a true parasite, hitherto unknown, inhabiting the vascular bundles. The evidence is considered conclusive that this organism is connected with root disease (but not with mosaic). In resistance to this trouble, cane varieties differ greatly, Otaheite (Cana Blafica) being very susceptible, while North Indian canes (as Kavangire) and those partly descended from such canes prove very resistant or practically immune. The life history of the organism has not been fully worked out. The vegetative stage consists apparently of a yellow plasmodium (partially described), which occupies the larger vessels of the vascular bundles, often completely filling them for considerable distances.

Investigations of root disease of sugar cane, J. MATZ (*Porto Rico Dept. Agr. Jour.*, 4 (1920), No. 1, pp. 28-40, figs. 6).—Sugar cane roots, like many other plants, are attacked by *Rhizoctonia* spp. and *Pythium* spp., which are common in the soils of Porto Rico. More than one form of *Rhizoctonia* has been isolated from diseased cane roots.

A new vascular organism in sugar cane, J. MATZ (*Porto Rico Dept. Agr. Jour.*, 4 (1920), No. 1, pp. 41-46, figs. 3).—The author follows up his study of fungi, as above noted, with a somewhat detailed descriptive account of the plasmodial organism mentioned by Earle in connection with the diseased cane vessels. The first discovery of the organism was made in the fall of 1919 in yellow striped diseased Cavengerie cane at Bayamon.

The relation of the organism to the cane is outlined, as supposedly unknown previously. The organism is technically described as a new species under the name *Plasmodiophora vascularum*, the indicated habitats being Mayaguez, Rio Piedras, and other localities, in cane fields, Porto Rico.

The root disease of the sugar cane, C. A. B[ARBEE] (*Internatl. Sugar Jour.*, 22 (1920), No. 264, pp. 675-679).—This is mainly a review of the paper by Earle and the two by Matz above noted.

Dry rot of swedes investigation, E. B. LEVY (*New Zeal. Jour. Agr.*, 21 (1920), No. 5, pp. 233-243, figs. 11).—Experimentation in line with that previously reported (*E. S. R.*, 45, p. 651) has been continued, most of the work having been conducted on the experimental areas at Gore and Winton under W. Alexander. The study and results are presented in detail as done in eight series of tests for different purposes. The work is to be continued.

Sweet potato diseases in New Jersey, R. F. POOLE (*New Jersey Stas. Circ.* 141 (1922), pp. 3-31, figs. 23).—Popular descriptions are given of the more common diseases attacking sweet potatoes in New Jersey, with suggestions for their prevention, the control measures recommended being seed selection, proper storage, treatment of seed, preparation of seed beds, and field sanitation.

Sand drown, a chlorosis of tobacco and other plants resulting from magnesium deficiency, W. W. GARNER, J. E. McMURTRY, and E. G. MOSS (*Science*, 56 (1922), No. 1447, pp. 341, 342).—A preliminary account is given of investigations conducted in cooperation between the Bureau of Plant Industry, U. S. D. A., and the North Carolina Department of Agriculture. The name sand drown is given to a characteristic chlorosis of the tobacco plant which is said to be likely to occur in aggravated form on the more sandy portions of fields after a heavy rainfall. As a result of considerable field and laboratory study, the trouble has been found to be due to an insufficient supply of magnesium in the soil or fertilizer. It has been further found that the ratio between the quantities of sulphur and magnesium contained in fertilizers is a factor of importance, symptoms of magnesium deficiency being intensified by an increase in the quantity of sulphur added to the soil. In addition to tobacco, similar effects are reported as having been observed on corn, the symptoms and characteristics of the disease corresponding quite closely to those described on tobacco.

Frost injury to tomatoes, R. B. HARVEY and R. C. WRIGHT (*U. S. Dept. Agr. Bul.* 1099 (1922), pp. 10, fig. 1).—On account of large losses due to the freezing of tomatoes in shipment, the authors have made a study of the effect of cold on the tomato plant and on the fruit. It was found that the average freezing point of 19 commercial varieties was 30.46° F., with a difference of 0.80° in the freezing points of certain varieties. No consistent difference was observed between the freezing points of ripe and practically full-grown green tomatoes of the same varieties, nor was there any consistent difference in the freezing points of early and late varieties. Six average tomatoes were undercooled in the laboratory to 22.63° before freezing commenced, the freezing point being 30.64°. It was found that tomatoes could be undercooled below their freezing point, and, if undisturbed, might remain without freezing for a limited time. A slight jar, however, while undercooled rendered them liable

to freezing. The possession of a thick skin with little tendency to crack is considered an important factor in the frost resistance of tomatoes.

Diseases of watermelons, W. A. ORTON and F. C. MEYER (*U. S. Dept. Agr., Farmers' Bul. 1277 (1922), pp. 31, figs. 21*).—A popular description is given and the control suggested for wilt, root knot, gummy stem blight, ground rot, anthracnose, stem-end rot, and a number of minor diseases to which the watermelon is subject.

Black spot of the pear and apple, W. K. DALLAS (*New Zeal. Jour. Agr., 22 (1921), No. 6, pp. 369-371*).—Pear and apple black spot control tests carried out at the Papanui Experimental Orchard, Christchurch, are described as satisfactory, reducing infection to a minimum. The varieties used are listed, and the treatments are indicated. Trees sprayed with Bordeaux mixture were all free from spot. Results from the treatment using lime sulphur with naphthalene were not concordant. Fungol gave good results.

Report of lime-sulphur spray tests for the control of peach blight, F. K. HOWARD (*Calif. Dept. Agr. Mo. Bul., 10 (1921), No. 5-6, pp. 172-176, figs. 2*).—Tests of three common brands of liquid lime sulphur and three brands of dry lime sulphur in comparative sprayings on a Muir peach orchard near Fresno, while showing some slight differences in the results obtained are considered to be about equally satisfactory for all, as the disease was controlled in each case.

The present status of lime-sulphur solution v. dry materials, G. P. GRAY (*Calif. Dept. Agr. Mo. Bul., 10 (1921), No. 5-6, pp. 177-182*).—A critical review of the history and present state of the question regarding the value of dry lime sulphur as an insecticide or fungicide in comparison with standard liquid sprays states that the fundamental question has not been answered, as no data have been obtained adequate to show that the sulphur compounds in the dry materials under study are of any greater insecticidal or fungicidal value than the same compounds in lime-sulphur solution when ready to apply. At the present time there is no evidence to support the claim that the compounds in these dry preparations of sulphur and lime will do twice the work of the same compounds in lime-sulphur solution.

[Grape] downy mildew [Australia], T. G. B. OSBORN (*Jour. Dept. Agr. So. Aust., 25 (1921), No. 2, pp. 120-125, figs. 2*).—Grape downy mildew appeared in Australia in 1916-17 and three years later in South Australia. Experiences with the mildew in Victoria are outlined for guidance in dealing with the disease locally.

Sprays with and without copper, E. MANCEAU (*Rev. Vitic., 55 (1921), No. 1430, pp. 384-386*).—Tests with fungicides, here briefly indicated, show superiority as regards downy mildew control on grapevines for alkaline Bordeaux mixture. Other preparations are discussed.

Lemon brown rot and its control, A. H. COCKAYNE and G. H. CUNNINGHAM (*New Zeal. Jour. Agr., 22 (1921), No. 5, pp. 271-274*).—Lemon brown rot (*Pythiacystis citrophthora*), first recorded for New Zealand in 1907 and within two years for all the lemon-growing districts, appears to be still on the increase, causing considerable damage by killing fruit, laterals, and even larger branches.

Factors regarded as essential in the spread of the fungus include excessive moisture, transmission of spores from fallen fruit to trees, and direct contact of diseased with healthy fruit. Methods for the control of conditions to prevent the spread of infection as here outlined do not interfere with the general practices of lemon growing and have proved satisfactory.

Kernel spot of the pecan and its cause, J. B. DEMAREE (*U. S. Dept. Agr. Bul. 1102 (1922), pp. 15, figs. 5*).—In an earlier publication by Rand (*E. S. R., 30, p. 452*) the kernel spot of pecan was attributed to *Coniothyrium caryoge-*

num. Later investigations by Turner (E. S. R., 39, p. 763) indicated that the spots were caused by punctures of insects. The author carried on a series of experiments with two varieties of pecans incased in wire cages in which the effect of southern stinkbugs (*Nezara viridula*) was determined. As a result of his investigations, he concludes that the pecan kernel spot is due to the mechanical rupturing of the host cells, the sucking of the plant juices, the injection of toxic substances into the tissues, or to all three types of injury.

Forest pathology [Canada] (*Canada Expt. Farms, Div. Bot. Interim Rpt., 1921, pp. 12, 13*).—Study during most of the summer of 1919 in the Timagami Forest Reserve in northern Ontario of white-pine leaf blight and various conifer heart rots gave only these clues in connection with the sudden appearance of leaf blight, that most of the roots of the blighted trees were dead, and that the mycorrhiza, normally present, was entirely absent in the case of blighted trees. The prevalent conifer heart rots were associated with *Polyporus schweinitzii*, *Trametes pini*, and *Fomes pinicola*. Among the hardwoods, white heart rot of poplars, *Fomes igniarius*, was common. *Napicladium tremulae* was prevalent on *Populus tremuloides* and *P. grandidentata*, causing death of young shoots.

Studies on nematode diseases in Sweden, H. A. A. VAN DER LEK (*Cultura, 33 (1921), No. 391, pp. 143-148*).—A review is given of recent contributions on nematodes (*Heterodera* spp.) affecting cereal plants.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Game laws for 1922, G. A. LAWYER and F. L. EARNSHAW (*U. S. Dept. Agr., Farmers' Bul. 1288 (1922), pp. 80*).—This is the usual annual summary of the provisions of Federal, State, and provincial statutes (E. S. R., 46, p. 151).

Laws relating to fur animals, 1922, G. A. LAWYER and F. L. EARNSHAW (*U. S. Dept. Agr., Farmers' Bul. 1293 (1922), pp. 30*).—This is the eighth annual publication on the subject (E. S. R., 46, p. 151).

Directory of officials and organizations concerned with the protection of birds and game, 1922, G. A. LAWYER and F. L. EARNSHAW (*U. S. Dept. Agr., Dept. Circ. 242 (1922), pp. 20*).—This is the usual annual directory (E. S. R., 46, p. 151) giving the addresses of officials and organizations from whom information can be obtained concerning game conditions and laws for the protection of wild life, etc.

A preliminary report on some under-water activities of certain waterfowl, E. H. FORBUSH (*Mass. Dept. Agr., Dept. Bul. 8 (1922), pp. 5-49, figs. 15*).—This extended discussion of the under-water activities of grebes, cormorants, and water turkeys is based upon personal observations and an extensive correspondence and review of the literature.

Saving birds at lighthouses (*Bird Lore, 24 (1922), No. 5, pp. 316-319, figs. 3*).—This is an account of a practical method devised by J. P. Thijsse, of the Netherlands, for preventing the destruction of birds at lighthouses on foggy nights during migration. The method consists in the erection of a series of parallel iron bars around and just below the light, where the bewildered birds perch and find safety until they can again get their bearings or daylight comes to their rescue. The perches are sufficiently commodious to give a total seating capacity of 30,000 birds. As many as 22,000 birds have been observed roosting on such a device at one time.

Summary of insect conditions throughout the United States during 1921, J. A. HYSLOP (*U. S. Dept. Agr. Bul. 1103 (1922), pp. 51, figs. 28*).—This is a summary of information obtained through the insect pest survey made under the author's direction with a view to collecting accurate and detailed

information on the occurrence, distribution, ecology, and relative destructiveness of insect pests throughout the United States for a study of the several factors that influence insect abundance. The insects dealt with include the bollworm, Hessian fly, chinch bug, green bug (*Toxoptera graminum* Rond.), pale western cutworm (*Porosagrotis orthogonia* Morr.), alfalfa weevil, sorghum webworm (*Celama sorghicella* Rtl.), European corn borer, camphor scale (*Pseudaulnidia duplicæ* Ckll.), Mexican bean beetle (*Epilachna corrupta* Muls.), sweet-potato weevil, apple leafhopper, seed-corn maggot (*Hydomyia ciliatula* Rond.), boll weevil, pink bollworm (*Pectinophora gossypiella* Saund.), Japanese beetle (*Popillia japonica* Newm.), satin moth (*Stilpnottia salicis* L.), gipsy moth, and the brown-tail moth. Maps are given showing the occurrence of these pests in injurious numbers throughout the year.

Insect problems in Indiana during 1921, J. J. DAVIS (*Jour. Econ. Ent.*, 15 (1922), No. 4, pp. 277-282).—This is a brief discussion of the more important entomological problems met with in Indiana.

[**Economic insects in Kansas**] (*Kans. State Hort. Soc. Rien. Rpt.*, 36 (1920-21), pp. 154-194).—Papers here presented include the following: Some Important Garden Insects (pp. 154-170) and Some Insects Injurious to Ornamentals (pp. 170-178), both by G. A. Dean; An Ounce of Prevention, by S. J. Hunter (pp. 178-182); Notes on the Plum and Apple Curculios (*Conotrachelus nenuphar*; *Anthonomus quadrigibbus*), by E. G. Kelly (pp. 183, 184); and Measures of Prevention, II, by S. J. Hunter (pp. 184-194).

Report of assistant entomologist, Vernon, M. H. RUHMANN (*Brit. Columbia Dept. Agr. Ann. Rpt.*, 16 (1921), pp. 69-73).—Included in this report is an account of the occurrence of insect pests of the year in the dry belt, of work with the onion maggot, and of dusting experiments for the control of the imported cabbage worm.

The work with the imported onion maggot, which is a continuation of that previously noted (E. S. R., 46, p. 352), shows that trap onions will take the major portion of the oviposition of the first brood of this pest during the most critical period of the growth of the seedling onions. The total cost in labor and material for this method of control does not exceed \$1.50 per acre, but there is a further loss of approximately 1.3 per cent of crop space through the use of the trap crop. This experiment is said to have been conducted over a period of three years under strictly commercial conditions with success, and it can be strongly recommended to onion growers under irrigated conditions.

Status of citrus pest control in central California, R. S. WOGLUM (*Calif. Citrogr.*, 7 (1922), No. 12, pp. 400, 401, 417).—This is a discussion of the insect problems met with in the citrus areas of central California.

[**The control of greenhouse pests**] (*North Dakota Sta. Bul.* 159 (1922), pp. 31, 32).—In referring briefly to this subject, it is stated that a solution of lye, 10 oz. in 20 gal. of water, proved satisfactory in controlling nematodes in the soil without injuring the plants.

Experiments with spray solutions for preventing insect injury to green logs, F. C. CRAIGHEAD (*U. S. Dept. Agr. Bul.* 1079 (1922), pp. 11).—An increasing demand for a practical spray that will prevent insect attack of crude forest products such as green saw logs and timbers used in rustic construction led to the investigations here reported. In considering the requisites of a practical spray, it is pointed out that, according to their method of attacking the wood, boring insects may be divided into four groups, namely, (1) those that lay eggs in crevices of the bark, the larvae from which bore through the bark and later into the wood, (2) those that gnaw a hole through the bark and insert the egg beneath, the larvae from which start feeding directly

beneath the bark and later bore into the wood, (3) those that bore through the bark and wood as beetles to make a suitable place for developing a new brood, the larvae of which, however, never cause injury, and (4) those that bore through the bark as beetles and lay the eggs beneath the bark, the larvae of which feed beneath the bark and loosen it.

Several of the more active poisons used in the experiments in sprays and dips seem to be effective against certain types of insects, particularly those of group 1. "They are especially effective when combined with oils that will penetrate the bark, as the mixture of corrosive sublimate and kerosene, or followed by another solution rendering them insoluble, as arsenic acid followed by lime water. This latter, however, is difficult to apply. They are also more effective when used on absorbent types of bark, as ash and juniper."

Experiments with Ambrosia beetles of group 3 are also recorded.

Experiments on the biology and tipburn disease of the bean leafhopper with methods of control (*Empoasca mali* LeB.), A. H. BEYER (*Jour. Econ. Ent.*, 15 (1922), No. 4, pp. 298-302).—This paper includes a brief account of the seasonal history of *E. mali*, the influence of climatic factors, its natural enemies, and methods of control, a later detailed account of which has been noted (*E. S. R.*, 47, p. 758). In spraying tests, the nicotine sulphate and whale oil soap gave the best results, with Bordeaux mixture nicotine sulphate giving the next best results.

Summary of a report on the froghopper blight of sugar cane in Trinidad, C. B. WILLIAMS (*Trinidad and Tobago Dept. Agr. Bul.*, 19 (1921), No. 2, pp. 52-65).—This is a summary of the report previously noted (*E. S. R.*, 46, p. 154).

A new aphid on California sage (*Aphis hiltoni* n. sp.), E. O. ESSIG (*Jour. Ent. and Zool.*, 14 (1922), No. 3, pp. 61-63, fig. 1).—The species here described as new occurs in dense colonies on the apical twigs of California sage (*Artemisia californica*).

Details of the technique adopted in following Weigl's plan of feeding lice infected with the virus of typhus fever by rectal injection, A. W. BACOT (*Brit. Jour. Expt. Path.*, 3 (1922), No. 2, pp. 72-74, figs. 2).—This is an account of the success met with in rectal feeding of lice by following the plan of Weigl in Warsaw.

Parasites of olive scale (*Ag. Gaz. N. S. Wales*, 33 (1922), No. 5, p. 322).—Brief notes are presented on observations by L. Gallard during the course of the rearing of two generations of the olive scale, together with two broods of chalcid parasites.

The chinch bug, R. H. PETTIT (*Michigan Sta. Circ.* 51 (1922), pp. 2, figs. 2).—This leaflet briefly describes the chinch bug and the dust mulch method of control.

The egg parasites of the coffee bug (*Antestia lineaticollis* Stal.) in Kenya Colony, F. W. DRY (*Bul. Ent. Research*, 12 (1921), No. 2, pp. 191-201).—Following a brief account of the life history of the coffee bug, the author reports upon studies made of the egg parasites *Hadronotus antestiae* and *Telenomus truncativentris*, two new species described by Dodd in 1919,¹ much of the data relating to which are presented in tabular form.

The forest Lepidoptera, M. WOLFF and A. KRAUSSE (*Die Forstlichen Lepidopteren. Jena: Gustav Fischer, 1922 pp. VIII+337*).—The first part of this work (pp. 3-38) is introductory in nature. The second or main part (pp. 39-304) consists of a systematic and biological account of the forest Lepidoptera, 480 forms being listed. The host plants, injury, manner of combat, and

¹ *Ent. Soc. London, Trans.*, pt. 3-4 (1919), pp. 321-382.

natural enemies of the various species are briefly considered. The lepidopterous species of the Palearctic fauna not previously considered in the literature of forest entomology are given in an appendix. A host index in which the insects are listed according to the parts of the tree attacked is included.

The third part (pp. 305-322, which is a botanical supplement, lists the important forest trees by their respective families, gives a list of botanical literature on forestry, of zoological literature, etc.

The woolly bear caterpillar (*Teracotona submacula* Wlk.), D. GUNN (*Union So. Africa Dept. Agr. Jour.*, 4 (1922), No. 6, pp. 542-547, figs. 5).—This is an account of a caterpillar which abounds in the gardens of Port Elizabeth and surroundings, causing extensive damage. In many gardens every plant of a succulent nature is either seriously injured or completely destroyed by it. The species is a native and is distributed throughout the Union of South Africa.

"It feeds upon a large number of wild and cultivated plants, but appears to favor cabbage, bean, beet, and lettuce. The eggs are deposited in clusters on leaves, stems, and twigs, and when the larvae emerge they defoliate the plants. The full life cycle occupies from 175 to 185 days, and there are two generations in a year. The eggs and caterpillars are frequently heavily parasitized. When the infested area is small, the caterpillars may be collected by hand and destroyed by either crushing or placing them in a receptacle containing a small quantity of paraffin and water, some miscible oil, or carbolic dip. In private gardens and market gardens the caterpillars can be readily controlled by spraying with arsenicals or by dusting with Paris green and lime."

An epizootic among caterpillars of *Galleria mellonella*, S. METALNIKOV (*Compt. Rend. Acad. Sci. [Paris]*, 175 (1922), No. 1, pp. 68-70).—The author reports upon an outbreak of disease among rearings of *G. mellonella*, it being the first in a period of more than 10 years. In his rearings, consisting of from 300 to 400 caterpillars, all had succumbed to the disease within a period of 24 hours, not a single individual surviving. Investigations have shown the presence of a long rod and a micrococcus—the characteristics of which are described—which when associated are extremely virulent for caterpillars of the bee or wax moth. In an epizootic observed later the rod associated with the micrococcus was larger, and they were much more virulent.

The maple case-bearer, *Paraclemensia acerifoliella* Fitch, G. W. HERRICK (*Jour. Econ. Ent.*, 15 (1922), No. 4, pp. 282-288, figs. 5).—This case-bearer, first noticed in New York State by Fitch during the summer of 1850, has become so abundant during the past three years and proved so destructive to sugar maples that the owners of many groves have become alarmed over the prospect of the destruction of their trees. This has led to the studies of the pest here reported.

***Eulia mariana* Fern., a new apple feeder in Pennsylvania and some related forms on apple, S. W. FROST** (*Jour. Econ. Ent.*, 15 (1922), No. 4, pp. 310, 311).—The author reports that, while not as abundant as the red-banded leaf-roller (*E. velutinana* Wlk.), previously referred to (*E. S. R.*, 44, p. 656), *E. mariana* has been repeatedly collected feeding both on the foliage and the fruit of the apple in Pennsylvania.

Effect of low temperature on the hatching of gipsy moth eggs, J. N. SUMMERS (*U. S. Dept. Agr. Bul.* 1080 (1922), pp. 14).—The discovery, during an extensive study of the gipsy moth, that in New England there are agencies of natural control responsible for a considerable mortality among the several stages led to investigations extending over a period of several years here reported. The work has shown that the failure of the egg clusters to hatch

is caused by low temperature, an exposure between -20 and -25° F. being necessary to kill entire clusters. Though some eggs in each cluster may be killed by an exposure of -15° , none will survive an exposure of -25° .

"When the temperature is low enough an average of 70 per cent of the clusters may be killed, but this desirable condition develops only in the northern part of the infested area and only during certain years. Snow will protect the egg clusters from the effects of the cold if it covers them; therefore, the greater the depth of snow the larger the number of clusters that will hatch the following spring. Maine and New Hampshire receive the greatest benefit from nonhatch. Central and northern Massachusetts also derive considerable benefit, particularly in restricted localities. Connecticut, Rhode Island, the southern and eastern parts of Massachusetts, and the coastal section of New Hampshire derive very little, if any, benefit, for even after the coldest winters nearly all eggs hatch. Nonhatch is of a periodic nature, as occasionally New England is visited by a mild winter, after which practically all eggs hatch. The benefit derived from nonhatch is offset to some extent by the injury cold weather works upon the parasites of the moth."

Zygobothria nidicola, an important parasite of the brown-tail moth, C. F. W. MUESEBECK (*U. S. Dept. Agr. Bul. 1088 (1922), pp. 9, figs. 4*).—This is a report of studies of the life history and bionomics of a European tachinid parasite of the brown-tail moth, first reared at the Gipsy Moth Laboratory during the summer of 1906 from caterpillars received from Europe the preceding winter. Notwithstanding discouraging results in rearing it, this tachinid became definitely established by 1910 and now occurs from Rhode Island to northeastern Maine, being relatively less abundant in the sections where very low temperatures are reached during the winter.

The adults of this species appear during the latter half of July and oviposit largely during the first three weeks of August. The egg is almost invariably placed on the venter of the host, and usually occupies a transverse position between two pairs of true legs or, less frequently, between two pairs of prolegs. Caterpillars from several days to two weeks old are preferred as hosts. Having been placed upon its host, the parasitic maggot begins to cut through the thin egg chorion and as soon as this is done it bores into the caterpillar. This act may be completed within 10 minutes, but normally it takes from 20 to 30 minutes. After entering its host the parasite lives free in the body cavity for about 10 to 14 days and feeds on the fat body of the slowly developing caterpillar. Then it enters the esophagus and remains there throughout its hibernation period of about nine months. Rather severe competition is encountered from two hymenopterous parasites *Apanteles lacticolor* Vier. and *Meteorus versicolor* Wesm., which also hibernate in the small brown-tail moth caterpillars, the presence of either in the same host with *Zygobothria* causing the death of the latter.

The host caterpillars commence feeding in the spring as soon as the buds open, but the *Zygobothria* maggots remain inactive for several weeks longer and do not again enter the body cavity of the caterpillar to feed until late May and early June. Soon after becoming established in the posterior end of its host and in the integumental funnel, the parasite molts into the second stage. Throughout this instar, which requires from 8 to 12 days, the maggot remains in the integumental funnel, and by the time it is ready to molt into the third and last larval stage, the host has spun its cocoon. From 4 to 5 days are required for the completion of the third instar, just before the end of which the host is killed, and the parasite forms its puparium in the integumental funnel inside the host. An average of from 25 to 30 days is spent in the puparium,

after which the flies appear, some 8 to 16 days prior to the hatching of the eggs of the brown-tail moth, just in time to insure fertilization and development of the ova.

This parasite has become a common species in New England and is of very great importance in the control of the brown-tail moth, especially in the southern part of the infested area. In dissections of thousands of hibernating brown-tail moth caterpillars from all sections of New England, it has been common to find from 20 to 30 per cent parasitism by *Zygobothria*.

The distribution of the pink bollworm of cotton, *Pectinophora gossypiella* Saund., in Porto Rico, G. N. WOLCOTT (*Jour. Econ. Ent.*, 15 (1922), No. 4, pp. 313, 314, fig. 1).—With this account the author gives a map which shows the wide distribution of the pest in Porto Rico.

The pink bollworm in Porto Rico, G. N. WOLCOTT, J. D. MORE, and F. SEIN, JR. (*Porto Rico Dept. Agr. and Labor Sta. Circ.* 63 (1921), Spanish ed., pp. 5-11, figs. 4).—A brief summary of information on *Pectinophora gossypiella* Saund., which was discovered in Porto Rico in 1921, where it is now quite widely distributed.

Notes on the characters by which the pink bollworm [*Pectinophora gossypiella*] and the false bollworm [*Pyroderces simplex*] may be distinguished, R. AVERNA-SACCÀ (*Bol. Agr. [São Paulo]*, 19. ser., No. 8-12 (1918), pp. 656-665, figs. 4; 20. ser., No. 10-12 (1919), pp. 522-569, figs. 26).—This anatomical study is illustrated by numerous pen drawings.

Tobacco plant injured by the seed corn maggot, W. E. BRITTON (*Jour. Econ. Ent.*, 15 (1922), No. 4, pp. 275, 276).—This relates to injury by *Hylemyia cilicrura* Rond. in Connecticut, an account of which has been noted from another source (*E. S. R.*, 47, p. 155).

The asparagus fly in the Department of Loir-et-Cher, H. GONDÉ (*Jour. Agr. Prat.*, 36 (1921), Nos. 26, pp. 13, 14, figs. 5; 27, pp. 35, 36, figs. 3).—This is a brief account of *Platyparea poeciloptera*, which causes serious injury to asparagus in France by mining the stem.

Biology of the papaya fruit fly, *Toxotrypana curvicauda*, in Florida, A. C. MASON (*U. S. Dept. Agr. Bul.* 1081 (1922), pp. 10, pls. 2).—This is a report of studies of an introduced species of fruit fly that occurs in Florida, an account of which by Knab and Yothers in 1914 has been noted (*E. S. R.*, 32, p. 60). The growing importance of this pest, due to its spread and the increase in the production of the papaya commercially, led to the further studies of its biology and control here reported.

The eggs, which are inserted into the seed cavity of the fruit, require from 12 to 14 days to hatch at any time throughout the year. The young maggots remain for about the first half of their existence within the seed cavity feeding on the seed coverings and other fibers there, after which they eat into the flesh of the fruit, first close to the cavity and then farther out until when mature they are close to the skin. The period required for larval development varies from 10 to 27 days. The pupal stage, which is passed in the soil under infested trees, was found to vary from 18 to 44 days. The average length of life of the adult is from 5 to 7 days. The insect breeds throughout the year in Florida and is present in all stages at any month, there being about six generations during the year.

Jumping spiders and small red ants are the only natural enemies observed by the author. A poison sirup was found to readily kill the adults, but it burns the trees very severely and can not safely be used. The number of flies can be very materially reduced and the growing of papayas be made practical and profitable through (1) the selection of good seed and the production of fruits of oblong shape and thick flesh, which will offer more or less immunity

to attack, (2) the conscientious destruction of the infested fruits on the trees early in the season before the maggots escape into the ground, and (3) the destruction of all inferior plants and wild plants around the place which might serve to breed the pests. If a planting is sufficiently isolated from other papayas the flies may be killed out by destroying all the plants in the spring, about April or May, and resetting new plants.

The mosquitoes of the United States, H. G. DYAR (*U. S. Natl. Mus. Proc.*, 62 (1922), Art. 1, pp. 119).—Included in this synopsis of the mosquitoes of the United States are a key to the tribes and genera, keys for the separation of the species, and an index to the genera and species.

Seacoast flea-beetle (*Disonycha maritima* Mann.) injurious to sugar beets in Sacramento Valley, Calif., H. H. P. SEVERIN (*Jour. Econ. Ent.*, 15 (1922), No. 4, p. 312).—The author records extensive injury to sugar beets by this flea-beetle in the Sacramento Valley, it riddling the foliage with holes and gnawing others in the beet root.

The rhinoceros or black beetle of coconuts (*Oryctes rhinoceros*), J. C. HUTSON (*Trop. Agr. [Ceylon]*, 59 (1922), No. 2, pp. 106-109, pl. 1).—This is a brief summary of information on *O. rhinoceros*.

The Mexican bean beetle in the southeastern United States, N. F. HOWARD (*Jour. Econ. Ent.*, 15 (1922), No. 4, pp. 265-275, figs. 2).—This is a progress report of work with *Eplachna corrupta* Muls., based upon investigations by the U. S. D. A. Bureau of Entomology in cooperation with the Alabama College Experiment Station. A map showing the distribution of the pest in the United States up to December 31, 1921, and a diagram of its life history, together with much tabular data, are included.

Experiments with contact insecticides for the control of the Japanese beetle (*Popillia japonica*), B. R. LEACH and F. J. BRINLEY (*Jour. Econ. Ent.*, 15 (1922), No. 4, pp. 302-305).—The discovery made in the summer of 1920 that a soap solution kills the Japanese beetle by contact led to experiments here recorded in tabular form. They show that sodium soya-bean and potassium soya-bean soaps, selling at 8 to 9 cts. per pound and used at the rate of 10 lbs. to 50 gal. of water, destroy as high as 90 and 80 per cent, respectively, of the Japanese beetle. The tests indicate that temperature is a limiting factor in the use of this treatment, the best results having been secured when the insects are exposed to the sun during the heat of the day.

Bionomics of weevils of the genus Sitona injurious to leguminous crops in Britain, II, D. J. JACKSON (*Ann. Appl. Biol.*, 9 (1922), No. 2, pp. 93-115, pl. 1, figs. 5).—This second part of the paper previously noted (*E. S. R.*, 45, p. 363) deals with *S. hispidula* F., *S. sulcifrons* Thun., and *S. crinita* Herbst.

S. hispidula is common throughout Great Britain on clover and alfalfa, the adults eating the leaves and the larvae damaging the roots; *S. sulcifrons* is frequently abundant upon seed clover, the larvae feeding upon the root nodules; and *S. crinita* frequents tares, clover, alfalfa, etc., but is rarely sufficiently common to cause injury. "The adults of *S. hispidula* are either fully winged or brachypterous, and two forms of brachypterous wings have been observed in *S. sulcifrons*. The life history of these three species has been investigated in Britain for the first time. There is only one generation in the year. The adults live 12 months. The period of oviposition and the length of the egg, larval, and pupal stages varies according to the species. The braconids *Perilitus rutilus* Nees, *P. cerealium* Hal., *P. aethiops* Nees, *Pygostolus falcatus* Nees, and a species of *Liothron* are recorded for the first time as parasites of the adult beetles. The fungus *Botrytis bassiana* (Balsamo) Mtgn. attacks these species of *Sitona*."

Broad-nosed grain weevil, R. T. COTTON (*U. S. Dept. Agr. Bul. 1085 (1922), pp. 10, pl. 1*).—The broad-nosed grain weevil (*Caulophilus latinasus* Say), first described from Florida in 1831 and thought to be a native species, is now widespread throughout that State and has been reported from South Carolina and Georgia. While more often found infesting stored corn and chick-peas, it commonly attacks a variety of seeds and cereals, reducing them to a powdery mass through the combined efforts of the larvae and adult weevils. The studies of the life history and habits of the weevil here reported are based upon observations made at Orlando, Fla., during 1919, 1920, and part of 1921. In addition to the United States, the species appears to be common in the West Indies, Mexico, Guatemala, and Madeira, and probably other Central American countries and in South America. The species appears to be unable to attack whole grain or seed of a medium degree of hardness, and is often associated with the rice weevil. It is known to breed in corn, chick-peas, millets, acorns, and seed of the avocado and has occasionally been found breeding in the roots of the dasheen and in sweet potatoes. The adult weevils feed readily on wheat, barley, wheat flour, ginger, and macaroni.

Data relating to the period and rate of oviposition, etc., and details of the life history of 19 individuals from date of deposition of the egg to emergence of the adult, together with the maximum, minimum, and mean temperature for the period of development, are reported in tabular form. The variation in the period of development from egg to adult was from 25 days for eggs deposited in August to 79 days for eggs deposited in November. The average length of life of the adult weevil is about 152 days when reared in captivity, with a maximum of 244 days for an unfertilized and 209 for a fertilized female.

The larva is attacked by the three hymenopterous parasites, *Cercocephala elegans* Westw., *Aplastomorpha vandinei* Tucker, and *Zatropis* sp., and the larvae, pupae, and eggs by a predacious mite, *Pediculoides ventricosus* Newp.

Technical descriptions of the immature stages and a list of 14 references to the literature are included.

A fumigant for cane grubs, E. JARVIS (*Facts About Sugar, 15 (1922), No. 15, pp. 300, 301*).—This is a report from the Bureau of Sugar Experiment Stations, Queensland, where paradichlorobenzene has given the best results in cane grub control thus far obtained. In experiments in which soil that had been dug 9 in. deep and allowed to settle for a few days was treated with a single line of 0.25-oz. injections placed 1 ft. apart and 5 in. below the surface, examinations 9 days later showed it to be more or less impregnated with the odor of the deterrent to a distance of 1 ft. each side of the injections. Larvae placed at from 6 to 8 in. were dead and partially decomposed, those at 9 in. dying but able to move convulsively, and those 1 ft. away alive and apparently normal.

"Grubs situated 9 in. from the chemical succumbed after 15 days, while those a foot distant, and control specimens, continued unaffected throughout the experiment. The test was repeated later, with practically identical results, and further trials, in which the injections were reduced to 80 grains, placed 1 ft. 6 in. apart, also proved satisfactory. . . .

"Investigations being conducted at the present time in very damp closely packed soil, in a field of first ratoons, have shown that injections of 4 gm. lost 0.5 gm. during a period of 18 days, from which we may gather that under such conditions evaporation would continue during a space of about four months. It is worth noting, however, that the deterrent odor remains in the ground long after all traces of its origin have vanished. Soil under cane stools treated March 5 was found strongly infected on May 8, three weeks after complete evaporation, from which we may reasonably assume that a limited area of

such contaminated soil—comprising, say, a strip at least a foot wide—would continue repellant until the odor became less decided.

"Dichlorbenzole [paradichlorobenzene] would prove an ideal fumigant for plant cane, as it could simply be put in the furrows with sets when planting, and if applied during November or December the odor would have ample time to penetrate and render the soil on each side of stools distasteful to the beetles and deter them from ovipositing in ground thus contaminated. In the event of eggs being deposited near the plants this fumigant would certainly kill any grubs that might hatch from them."

In no instance has experimentation with this fumigant been followed by noticeable injury to the growing cane plants.

Descriptions of miscellaneous new reared parasitic Hymenoptera, A. B. GAHAN (*U. S. Natl. Mus. Proc.*, 61 (1922), Art. 24, pp. 24, pl. 1).—The 12 species here described as new are *Rogas hyphantriae*, reared from *Hyphantria* sp. at Fredericton, N. B.; *Microbracon caulicola*, reared from *Pyrausta ainsliei* Heinr. at Urbana, Ill., and probably at Schenectady, N. Y., and apparently also from *P. nubilalis* at Ipswich, Mass. and *P. pentahis* at Knoxville, Tenn.; *M. papaipemae*, reared from *Papaipema frigida* Smith at Rye, N. Y.; *Gelis microplitidis*, reared from cocoons of *Microplitis gortynae* Rtl. parasitizing *Papaipema nebris* Guenée at Rye; *Podagrion crassidara*, from eggs of *Mantis* sp. at Brownsville, Tex.; *Harmolita lolii*, from stems of *Lolium temulentum* L. at Elk Grove, Calif.; *Polyscelis modestus*, reared from Hessian fly puparia at Hanover and Carlisle, Pa.; *Anastatus microcentri*, reared from eggs of *Microcentrum* sp. at Carlisle and Washington, D. C.; *Calosoter metallicus*, reared from wheat stems containing *Harmolita* sp. at San Miguel, Calif., and also from *Phytophaga destructor* (Say) at Concord, Calif.; *Coccophagus saissetiae*, reared from *Saissetia nigra* Niet. at Ancon, Canal Zone; *Ardalus antillarum*, reared from larvae of *Protes nero* Fab. at Caguas, P. R.; and *Telenomus* (*Prophanurus*) *busseolae*, reared from the eggs of *Busseola fusca* (Hamp.), a stalk borer, at Cedura, Natal, South Africa.

Argentine ant control campaigns in Mississippi, R. W. HARNED and M. R. SMITH (*Jour. Econ. Ent.*, 15 (1922), No. 4, pp. 261-264).—This is a brief report of successful control campaigns conducted in towns in Mississippi in cooperation with the U. S. D. A. Bureau of Entomology.

Notes on American gallflies of the family Cynipidae producing galls on acorns, with descriptions of new species, L. H. WEID (*U. S. Natl. Mus. Proc.*, 61 (1922), Art. 19, pp. 32, pls. 5, figs. 3).—The present paper gives descriptions of 12 new species, together with a synopsis of the galls and keys for the determination of the adults.

A revision of the North American ichneumon flies belonging to the subfamilies Neoneurinae and Microgasterinae, C. F. W. MUESEBECK (*U. S. Natl. Mus. Proc.*, 61 (1922), Art. 15, pp. 76, pl. 1).—This is a contribution from the Gipsy Moth and Brown-tail Moth Branch of the U. S. D. A. Bureau of Entomology, which includes tables of the known genera of the braconid subfamilies Neoneurinae and Microgasterinae, keys to the North American species, descriptions of 34 new species, and synonymical notes, also figures of the fore wing of representative species of North American genera known to the author.

Douglas fir seed fly (*Megastigmus spermotrophus* Wachtl.) [*Gr. Brit. J. Forestry Comn. Leaflet* 8 (1921), pp. 3, figs. 4).—This is a brief account of *M. spermotrophus*, a small chalcidid which attacks the kernel and completely destroys a large proportion of Douglas fir seed.

Beekeeping, A. KALTENBACH (*Die Bienenzucht: Anweisung zur Behandlung eines Bienenvolkes nach Moderner Betriebsweise. Munich-Gladbach: Volksvereins-Verlag, 1921, pp. 93, figs. 36*).—This is a small handbook on beekeeping.

FOODS—HUMAN NUTRITION.

Bacteria and molds in dehydrated vegetables, S. C. PRESCOTT, P. F. NICHOLS, and R. POWERS (*Amer. Food Jour.*, 17 (1922), No. 6, pp. 11-16, figs. 6).—This contribution from the Bureau of Chemistry, U. S. D. A., consists of a report of a study of the numbers and types of bacteria and molds found on dehydrated vegetables, the relation of temperature and humidity during storage to the development of these organisms, and the relative efficiency of different types of containers in preventing spoilage of dehydrated products. The dehydrated vegetables used were obtained from three commercial dehydrating plants in different sections of the country and included shredded cabbage and carrots; sliced onions; riced, quartered, and sliced potatoes; spinach; sliced tomato; shredded and sliced turnips; turnip tops; and a soup mixture. Suspensions of the dehydrated products in water in 1 to 20 dilution were incubated at 37° C. for 2 hours in order to loosen and free the microorganisms from the material. Varying dilutions were then plated on plain and dextrose agar and incubated at 37° for 48 hours, after which counts were made in the usual manner. The various types of colonies were then isolated and identified.

This preliminary study showed that bacteria and molds are normally present in commercially dried vegetables, the former varying in number from several thousand to several hundred thousand per gram and the latter from several hundred to several thousand per gram. The bacteria belonged chiefly to the soil and water types, and the molds were the common molds of decay.

In the study of the effect of varying conditions of storage on the bacterial and mold count, two types of containers were used, one a small friction-top tin can in which the product remained practically constant in moisture content, and the other a small waxed paper carton which allowed the product to lose or absorb moisture depending upon the relative humidity of the atmosphere. The vegetables were stored in the two types of containers, exposed to different conditions of temperature and humidity for 2, 4, and 6 weeks, and then examined for moisture content, number of bacteria and molds per gram and change in appearance.

It was found that, under all conditions of temperature, if the moisture was kept below the critical point at which multiplication of organisms occurred, there was first a gradual decrease in the number of bacteria, after which the number remained constant. Under the same conditions the number of mold spores remained the same. When stored in a humid atmosphere under conditions permitting absorption of moisture, there was a rapid increase in the number of bacteria and molds, with an increase in the moisture content.

An examination of different types of containers confirmed the conclusion that moisture is the chief factor in the development of microorganisms and in the subsequent decay of the vegetable. Tin cans with friction tops rendered perfect protection against moisture absorption, while paper cartons, paraffined and unparaffined, were suitable under dry conditions of storage but did not prevent spoilage when the conditions were humid. Paraffined cartons protected the products longer than unparaffined.

Inspection of fruit and vegetable canneries, compiled by F. B. LINTON (*U. S. Dept. Agr. Bul.* 1084 (1922), pp. 38).—This publication has been compiled to furnish information to food inspectors on the inspection of fruit and vegetable canneries for the purpose of preparing a report to serve as a basis for administrative action in the enforcement of a food-control law. General features of cannery inspection are first discussed, including the establishment of right relations with the proprietor, and the examination of raw materials,

surroundings of the cannery, canning processes, the finished products, grades and labels, and the sanitary features of the factory. This is followed by specific directions for tomato cannery inspection and for making an inspector's report, the latter being illustrated by a typical form for reporting the inspection of a pea cannery. The rest of the publication consists of brief statements concerning the customary procedures in the commercial canning of specific fruits and vegetables.

Soy bean, the most perfect crop plant, J. J. WILLAMAN (*Amer. Food Jour.*, 17 (1922), No. 7, pp. 11, 12, fig. 1).—A popular article on the utilization of soy beans in human nutrition.

What to feed a child during the first year, J. C. WINTERS (*Tex. Univ. Bul.* 2204 (1922), pp. 15).—This is a collection of useful information on the artificial feeding of infants during their first year, together with a brief discussion of the optimum diet for the mother during pregnancy and nursing.

Your child needs milk, vegetables, fruit, and whole grains. Is he getting them? M. BIRDSEYE (*Child Welfare Jour.*, 1 (1922), No. 1, pp. 18-21).—An account is given of a plan for food selection in child welfare work, whereby the body needs will all be met. This embodies the conclusions reached as a result of a number of conferences of extension specialists.

[**Child welfare work of Saskatchewan**] (*Pub. Serr. Mo. [Saskatchewan]*, 10 (1922), No. 12, pp. 1-2).—This summary and discussion is based upon an address by F. C. Middleton at the twelfth annual convention of the Homemakers' Clubs, University of Saskatchewan, June 21, 1922.

Railroad eating house and dining car catering (*Hotel Mo.*, 30 (1922), No. 350, pp. 58-67, figs. 15).—An account is given of the system used on the dining cars and lunch rooms of the St. Louis Southwestern Railway. Forms used for keeping track of foods and furnishings, etc., are shown, also typical menus. A feature of this service is the attention paid to local foods.

Effects of chronic starvation during the siege of Kut, P. HEHR (*Brit. Med. Jour.*, No. 3205 (1922), pp. 865-868).—This paper consists of notes on the state of nutrition and general health of the members of the British garrison toward the close of the siege of Kut, which lasted from December 4, 1915, to April 29, 1916. During the siege the rations were gradually reduced from 3,600 calories for the British soldiers and 3,100 for the Indian to 1,850 and 1,110 calories, respectively. The final ration of the British soldier consisted of brown bread 6 oz., lean horseflesh 24 oz., and green stuff, herbs, and grass 2 oz. daily and of the Indian troops coarse barley flour 5 oz., lean horseflesh 12, and green stuff 4 oz. Among the effects of this starvation diet were progressive loss in weight, lowering of the body temperature, inclination to sleep, and reduction of the pulse rate. The chief diseases during the siege were diarrhea, dysentery, chronic debility, and scurvy among the Indian and beriberi among the British troops, as previously noted (*E. S. R.*, 43, p. 262).

The paper closes with a discussion of the methods of treatment of chronic starvation. The necessity is emphasized of great caution and discretion in returning to ordinary food after long periods of partial starvation. The author states that in his own case it was about two years before the digestive organs had recovered their normal functional activity.

Studies on the digestibility of proteins in vitro.—III, On the chemical nature of the nutritional deficiencies of arachin, D. B. JONES and H. C. WATERMAN (*Jour. Biol. Chem.*, 52 (1922), No. 2, pp. 357-366).—The methods of artificial digestion employed in previous studies of this series (*E. S. R.*, 46, p. 163) have been applied to arachin with a view to determining whether the biological inadequacy of this protein is due to incomplete digestibility, as suggested by Sure (*E. S. R.*, 44, p. 462).

Arachin was found to be less readily digestible *in vitro* by pepsin and trypsin than any of the proteins thus far tested under the same conditions. Attempts to improve its digestibility by boiling with water at ordinary pressure or by heating with steam at 15 lbs. pressure were unsuccessful. On subjecting arachin to hydrolysis with N/10 sodium hydroxid at 80° C. a partial cleavage product was obtained which contained about 33.8 per cent of the original protein. Of the 1.88 per cent of histidin contained in arachin, 1.31 per cent was found in this cleavage product, of 13.51 per cent arginin 4.55, of 1.14 per cent cystin 0.37, and of 4.98 per cent lysin 1.95 per cent. This partial cleavage product proved very difficultly digestible *in vitro*. It is considered possible that the action of pepsin and trypsin upon this protein may be similar to the action of dilute hot alkalis, and that perhaps the nutritional failure of arachin may be due to the large proportion of the basic amino acids found in the alkali-resistant fraction of the protein.

The relation between the endogenous catabolism and the nonprotein constituents of the tissues. H. H. MITCHELL, W. B. NEVENS, and F. E. KENDALL (*Jour. Biol. Chem.*, 52 (1922), No. 2, pp. 417-437).—Various theories concerning endogenous nitrogenous catabolism are reviewed and discussed, and an experimental investigation is reported, the results of which are thought to lend support to the theory advanced by the authors that "the minimum endogenous catabolism of nitrogenous compounds is essentially not a catabolism of protein but of nonprotein substances." The evidence upon which this theory is based is that analyses of the body tissues of rats killed after varying periods on an ordinary diet, a nonprotein diet, and starvation show a remarkable constancy in the concentration of the total nonprotein nitrogen and sulphur and of the amino nitrogen. The values obtained for creatin were all lower in the tissues of the rats on a nitrogen-free ration than on a normal ration. This is thought to be due to the absence of an exogenous protein catabolism.

"It would appear that most of the creatin in the tissues is present as an integral part of the protoplasmic mechanism, performing some function in the life of the cells. A relatively small and variable fraction of the creatin in the tissues would seem to be derived from the catabolism of dietary protein, probably representing an intermediate state in the catabolism of arginin and possibly other amino acids. If the intake of dietary protein is excessive, and particularly if the protein is rich in arginin (and possibly other creatin precursors), some of the creatin, produced normally only as an intermediary product, finds its way into the urine."

The H-ion concentration of human feces. C. S. ROBINSON (*Jour. Biol. Chem.*, 52 (1922), No. 2, pp. 445-466, figs. 3).—This contribution from the Michigan Experiment Station consists of a study of the reaction of human feces from apparently healthy subjects on mixed diets. By the use of various laxatives it was found possible also to study the effects on the reaction of the retention of the material in the intestines. A study was also made of the influence on the fecal reaction of inoculating the intestines with acid-forming bacteria. All H-ion concentration determinations were made electrometrically, using the general technique and apparatus of Clark.

From repeated examination of the feces of two healthy men and from single tests of the feces of many other individuals, the conclusion has been drawn that the normal fecal reaction varies between pH 7 and 7.5. It is noted, however, that when a series of observations is made over a long period, occasional values are found which are outside this range.

The effect of common laxatives, whether alkaline or not, is the production of an acid stool. An exception to this was physiological salt solution, which

caused a marked laxative effect with no change in reaction. Diarrhea was accompanied by acidity and constipation by alkalinity of the feces.

No change in reaction of the feces was brought about by the introduction of acidophilic bacteria into the intestines. In some subjects, however, the consumption of lactose in addition to the *Bacillus acidophilus* cultures caused an increase in the acidity of the feces. It is suggested that infants may exhibit the same sensitiveness to this sugar, which would explain the reported acidity of infant feces on a diet of human milk which contains much more lactose than cow's milk. The conclusion is drawn that the physiological factor is the predominant one in influencing fecal reaction.

Note on urinary tides and excretory rhythm, J. A. CAMPBELL and T. A. WEBSTER (*Biochem. Jour.*, 16 (1922), No. 4, pp. 507-513).—The study of day and night urine under different conditions (E. S. R., 47, p. 64) has been extended to analyses of day and night urine (1) during a routine of day starvation for 48 hours with food only at night, (2) during complete starvation for 24 hours, and (3) during a reversed routine for 96 hours, the subjects sleeping during the day and working with regular meals during the night.

Under the starvation routines no change took place in the differences between day and night urine. The total nitrogen, urea nitrogen, water, and chlorids were excreted in greater quantities during the day than at night, and the acidity, phosphates, and ammonia nitrogen were greater at night than during the day. In the reversed routine the phosphates for the day were greatly increased in the two subjects carrying on the test. In one subject the other results were about the same as with the regular routine, while in the other the acidity and ammonia nitrogen were also higher during the day when sleep was taken.

In discussing the data obtained, it is pointed out that consideration must be taken of the fact that the subjects were not used to the reverse routine, and that the results, therefore, belong to a transitional period. It is emphasized, however, that the higher figures for phosphates, whether found by day or by night, always accompanied sleep.

The importance of zinc in the nutrition of animals.—Experiments on mice, G. BERTRAND and B. BENZON (*Compt. Rend. Acad. Sci. [Paris]*, 175 (1922), No. 5, pp. 289-292).—Further evidence of the need of the animal organism for zinc (E. S. R., 46, p. 667) is considered to be furnished by data reported in this paper.

Twenty mice comprising five litters were placed at weaning on synthetic diets differing only in zinc. Aside from various purified salts, the diets consisted of potato flour, casein, cellulose, lactose, and cocoa butter, all of the ingredients being freed from traces of zinc. To the food of half the animals in each litter 0.01 gm. of crystallized zinc sulphate was added for every 100 gm. of the basal diet. The amount of food eaten, loss in weight, and survival period of all the animals are tabulated. In each litter the animals receiving the addition of zinc lived considerably longer than those receiving no zinc.

The practical application of the results of vitamin studies, L. E. HOLT (*Jour. Amer. Med. Assoc.*, 79 (1922), No. 2, pp. 129-132).—A general discussion from the medical point of view and with particular reference to the nutrition of children.

A modification of basal diet for rat feeding experiments, M. BOND (*Biochem. Jour.*, 16 (1922), No. 4, pp. 479-481, fig. 1).—The use of dried egg white in place of casein in basal vitamin A free diets for rats is suggested on account of the difficulty in freeing casein completely from vitamin A. The egg white is first soaked over night in tap water and the solution then heated gently to coagulate the protein. The basal ration first used consisted of the soaked and cooked egg white 30, salts 5, marmite 5, strained lemon juice 5,

potato starch 40, and hardened cottonseed oil 15 parts. The growth curves of three rats on this diet showed considerable growth for about four weeks, after which the curves flattened out.

In experiments with a lactating rat and her young some evidence was obtained that the amount of protein was excessive, and consequently a second series of experiments is under way in which the amount of protein has been reduced to 20 per cent.

Observations on the distribution of vitamin B, S. R. DAMON (*Jour. Amer. Med. Assoc.*, 79 (1922), No. 2, pp. 128, 129, figs. 2).—A limited amount of evidence is presented from which the conclusion is drawn that commercial beef extract and peptone are devoid of vitamin B. The materials tested were administered to rats declining on a diet lacking in vitamin B, the amounts given comprising 2.5 and 7.5 per cent of the ration.

In the four cases reported for peptone the decline in weight continued, as also in the two cases in which beef extract was given to the extent of 2.5 per cent of the basal diet. The two curves presented for the 7.5 per cent beef extract show a very slight growth for two weeks, followed by a decline.

The preparation of cod liver oil and the effect of the processes on the vitamin value of the oils, J. C. DRUMMOND and S. S. ZILVA (*Jour. Soc. Chem. Indus.*, 41 (1922), No. 15, pp. 280T-284T, fig. 1).—This is a detailed report of an investigation at the chief centers of the cod liver oil industry in Norway of various methods in use for the manufacture and refining of cod liver oil with reference to possible destruction of the vitamin A content of the oil. A general description is given of the cod fisheries of Norway, the methods of the manufacture of the oil, and the uses to which the different products of refining are put, and data are presented on the relative values of the different products as sources of vitamin A. The conclusions drawn from this investigation have been noted in part from another source (*E. S. R.*, 47, p. 768).

The chief variations in the vitamin activity of fish liver oils are thought to be due not to the methods of manufacture and refining, but chiefly to changes in the diet or the physiological state of the fish at different seasons. From the standpoint of vitamin efficiency, it is considered unnecessary to prohibit the mixing of cod liver oils with other fish oils or to remove the stearin from the oils as is now done in the better quality oils. It is suggested that if this removal is advisable for other reasons the stearin should be used for edible purposes instead of technical on account of its high content in vitamin A. A daily dose of 0.1 gm. of the stearin is said to give better growth than an equal amount of an average sample of dairy butter.

The etiology of rickets in infants: Prophylactic and curative observations at the Vienna University Kinderklinik, H. CHICK, E. J. DALYELL, M. HUME, H. M. M. MACKAY, and H. H. SMITH (*Lancet [London]*, 1922, II, No. 1, pp. 7-11).—This is a brief report of an extensive inquiry into the etiology of rickets, the investigation being conducted under particularly favorable conditions at the Vienna University Kinderklinik where, through the cooperation of C. F. Pirquet, it was possible to study the influence on the prophylaxis and cure of rickets (1) of diet under constant conditions of general hygiene and (2) of light under constant conditions of diet.

For the first part of the study 64 cases were under observation for periods of from 5 to 15 months. On admission to the hospital the infants, none of whom showed any evidence of rickets, were placed in two groups on Diets I and II. Diet I consisted of fresh undiluted milk, with the addition of from 8 to 10 per cent of sugar, cereals after the age of 5 months, and later fresh fruits and vegetables. Diet II consisted of standardized full-cream dried milk

prepared to yield a fluid containing 13 per cent of solids, 3.4 per cent of protein, 3.4 per cent of fat, and 5.3 per cent of sugar. This was further diluted for infants under 3 months, and for older infants additions of cereals were made. The infants in this group also received varying amounts up to 8 gm. daily of cod liver oil. In both groups there was a daily allowance of from 5 to 10 cc. of raw lemon juice, swede juice, or tomato juice. It is stated that the vitamin A value of the milk in both diets was low. X-ray diagnoses were taken as the criteria for the presence or absence of rickets, and the results obtained were grouped to show the influence of season, diet, and age upon the incidence of rickets. During the summer no case of rickets was detected in either group. In late winter and spring 14 of the infants on Diet I developed rickets but none on Diet II. Most of the cases occurred in infants under 6 months of age.

Observations on the effect of light were made on 14 infants developing rickets, as noted above, and upon 18 more severe cases admitted to the hospital between January and April. With the exception of one child 2 years of age, all were from 4 to 18 months old when treatment began. Three methods of treatment were studied: Treatment with cod liver oil 6 cases, exposure to the mercury vapor quartz lamp 7 cases, and outdoor treatment 12 cases. The rest, serving as controls, remained indoors with no change in diet.

In the cod liver oil treatment the oil was given in from 5 to 10 gm. daily doses, starting with from 1 to 2 gm and increasing as rapidly as possible. Healing processes could be demonstrated radiographically in from 2 to 4 weeks. The treatment with the mercury vapor quartz lamp was given 3 to 4 times weekly, beginning with 5 minutes' exposure at a distance of from 80 to 100 cm., the time being gradually increased to 30 minutes and the distance reduced to 60 cm. The results obtained were indistinguishable radiographically from those obtained with cod liver oil, healing of the rickets being apparent in from 2 to 4 weeks. The outdoor treatment consisted in exposing the patients for varying periods to weather conditions. Seven cases were exposed to direct sunlight, 2 were shaded from the direct rays of the sun, and 3 were exposed to sunlight and also had additions of cod liver oil to the diet. The response was relatively most marked in cases receiving cod liver oil and exposure to sunlight simultaneously, and the rate of bone healing in the others was proportional to the amount of exposure. The controls remained in about the same condition during the early spring, but in May tended to show slow recovery.

In discussing these results particular emphasis is placed on the identical action of cod liver oil and light therapy, and the possibility is suggested that if the antirachitic action of cod liver oil is due to its content of vitamin A or some factor with a similar distribution, the similar effect of light may be due to a special photosynthesis of this vitamin in the animal body.

Note on the X-ray diagnosis of rickets, H. WIMBERGER (*Lancet [London]*, 1922, II, No. 1, pp. 11, 12).—In connection with the above report, a brief description is given of the radiographic evidences of the onset and beginning of healing of severe rickets.

The phospholipin of the blood and liver in experimental rickets in dogs, J. S. SHARPE (*Biochem. Jour.*, 16 (1922), No. 4, pp. 486-488).—The blood and livers of some of the experimental puppies used in the investigation of rickets by Paton and Watson (*E. S. R.*, 46, p. 360) have been examined for their phospholipin content with a view to throwing some light on the theory developed by Paton (*E. S. R.*, 47, p. 587) of a disturbance in the metabolism of phospho-

lipins in rickets. While the data obtained are not extensive enough to warrant definite conclusions, the phospholipins of the blood and the liver in the rachitic pups studied were lower than in the nonrachitic. Likewise, the amount of phospholipins in the liver was smaller in proportion to that in the blood in rachitic than in nonrachitic animals.

The influence of light in prevention and cure of rickets, A. F. HESS (*Lancet* [London], 1922, II, No. 8, pp. 367-369).—In this lecture, given before the Royal Society of Medicine, London, on July 7, 1922, the author reviewed the evidence previously reported on the rôle of light in the etiology of rickets and reported briefly further experiments undertaken with a view to establishing the limits of this action.

By the use of a series of filters allowing the passage of light rays of different lengths, it was found that the protective rays are in the ultraviolet zone and are about 300 μ or shorter. The intensity of the light, as well as the wave length, was found to play an important part in the protection secured by radiation. By the use of cloth filters of various kinds, it was found that there is a certain amount of filtration of the active light rays through the fabric, depending upon its texture and color. Exposure of rats to Roentgen rays in small doses did not protect the animals from rickets, nor was rickets induced by massive doses of these rays.

The use of morphin in connection with serumtherapy of botulism, J. BRONFENBRENNER and H. WEISS (*Soc. Expt. Biol. and Med. Proc.*, 19 (1922), No. 6, pp. 296, 297).—It is reported briefly that in an attempt to find a substitute for ether anesthesia in the serum therapy of botulism (E. S. R., 46, p. 64) morphin has given the best results. The subcutaneous injection of 0.02 gm. of morphin in 10 per cent solution into 250-gm. guinea pigs following the ingestion of 125 M. L. D. of botulinus toxin has been found to delay the death of the animal from the toxin by from 16 to 34 hours, thus making it possible to save the animal if antitoxin is administered as late as 24 hours after the ingestion of the toxin.

ANIMAL PRODUCTION.

On a method of estimating the number of genetic factors concerned in cases of blending inheritance, W. E. CASTLE (*Science*, 54 (1921), No. 1387, pp. 93-96).—The author suggests a method of calculating the number of genetic factors involved in blended inheritance, which consists of a table showing the calculated F_2 standard deviations expressed in percentage of the difference between the parental races where from 1 to 384 different genetic factors are involved. In calculating the number of factors involved in any specific case, the following formula is suggested:

$$\frac{\text{Difference between the standard deviations of } F_1 \text{ and } F_2}{\text{Difference between the means of the 2 pure parental races}} \times 100$$

The result is compared with the nearest percentage standard deviation shown in the table, and the number of factors involved are thus determined. The application of this method to corn and rabbit crosses is shown. Where all factors involved in blending inheritance are not of equal value, of course this method would not apply.

Inheritance of webbed toes, R. SCHOFIELD (*Jour. Heredity*, 12 (1921), No. 9, pp. 400, 401, figs. 2).—The occurrence of webbed skin between the second and third toes in all the male offspring of males showing this character is noted in the author's family. None of the females show this character, and evidence indicates that they can not transmit it.

The Y-chromosome type of sex-linked inheritance in man, W. E. CASTLE (*Science*, 55 (1922), No. 1435, pp. 703, 704).—In a discussion of the above article, the author shows the similarity between the inheritance of the webbed toes and the distribution of the Y-chromosome. Special reference is made to a character inherited in a similar manner in fish (*U. S. R.*, 45, p. 370).

The relation of the endocrine glands to heredity and development, L. F. BARKER (*Science*, 55 (1922), No. 1435, pp. 685-690).—In the presidential address before the 1922 meeting of the Eugenics Research Association, the author discusses the endocrine organs with special reference to the possible influence of hormones on heredity. His conclusions appear to be mainly negative.

The method of balancing rations, B. I. MASUROVSKY (*Jour. Dairy Sci.*, 5 (1922), No. 3, pp. 291-300).—The author suggests the use of a "United Feeding Standard," which is claimed to be a fusion of the merits of the modified Wolff-Lehman, Armsby, and Haeccker standards for balancing rations. The proper relationship between the nitrogenous, carbonaceous, and bulky feeds should be maintained, and an example of the process of balancing a ration for a herd is given.

The rôle of cystin in the dietary properties of the proteins of the cowpea, *Vigna sinensis*, and of the field pea, *Pisum sativum*, A. J. FINKS, D. B. JONES, and C. O. JOHNS (*Jour. Biol. Chem.*, 52 (1922), No. 2, pp. 403-410, figs. 4).—In reporting the results of experiments carried on at the Bureau of Chemistry, U. S. D. A., to determine the feeding values of cowpeas and field peas for rats, it was shown that cooked or raw cowpeas, when composing 70 per cent of the ration (16.5 per cent protein), produced only one-third to two-thirds of the normal rate of growth. When 0.33 per cent of cystin was added to the ration normal growth was obtained. With field peas, either raw or cooked, as 61 per cent (16.5 per cent protein) or 75 per cent (20 per cent protein) of the diet, normal or very nearly normal growth followed. The other ingredients in the rations were Osborne and Mendel's salt mixture, starch, butter fat, and lard.

The chemical composition of guinea grass and Para grass with reference to their feeding values for animals, F. A. LÓPEZ DOMÍNGUEZ (*Porto Rico Dept. Agr. and Labor Sta. Circ. 61* (1922), Spanish ed., pp. 5-35).—The chemical analyses of a number of samples of Para grass and guinea grass in different stages of maturity and growth grown on different types of soil are given on fresh and air-dried bases, with averages for the immature and mature samples and those grown on the different types of soils, as well as similar analyses of these materials previously reported by other investigators. The following table gives the average composition of the fresh mature and immature samples:

Average percentage composition of all mature and immature samples of Para and guinea grass analyzed.

Kind of grass.	Stage.	Water.	Protein.	Fat.	Fiber.	Carbo- hydrate.	Ash	Energy.	Nutri- tive ratio.
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Calories.</i>	
Para.....	Immature....	82.02	2.18	0.76	5.13	7.47	1.40	0.052	1:4.2
Do.....	Mature.....	72.95	2.13	.56	7.48	11.37	2.43	.077	1:5.9
Guinea.....	Immature....	77.38	1.82	.54	6.67	9.61	2.27	.084	1:6.9
Do.....	Mature.....	70.00	1.56	.62	9.94	12.21	2.78	.085	1:8.7

A discussion is also given of the place which these feeds may take in the rations of dairy cows, horses, and mules.

New African feeding stuffs (*Bul. Imp. Inst. [London], 19 (1921), No. 4, pp. 452-457*).—The analyses of the seeds of *Sesbania cinerascens*, *Crotalaria juncea*, and *Schotia*, near *latifolia*, which were received from Africa, were determined as follows:

Composition of the seeds.

Seeds.	Moisture.	Crude protein	Fat	Fiber.	Carbo-hydrates	Ash.	Nutritive ratio.	Food units ¹
	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>		
<i>Sesbania cinerascens</i>	11.4	21.7	4.8	12.2	47.0	2.9	1:2.7	113
<i>C. juncea</i>	8.6	34.6	4.3	8.1	41.1	3.3	1:1.5	138
<i>Schotia</i> near <i>latifolia</i>	8.6	9.8	2.6	8.7	68.2	2.1	1:7.6	99

Equals percentage of starch plus 2.5 times the sum of the percentages of fat and crude proteins.

Alkaloids were thought to be present in the *Sesbania* seeds. None of the seeds were reported as being very palatable. In referring to the analyses of *Sesbania* seeds previously noted (*E. S. R.*, 43, p. 170), it is stated that the species was *mossambicensis* and not *aculeata* as believed.

Commercial feeding stuffs, 1921-22, J. M. BARTLETT (*Maine Sta. Off. Insp.*, 104 (1922), pp. 25-43).—This is the usual annual report of official inspections of feeding stuffs (*E. S. R.*, 46, p. 572) containing the guaranties and analyses as found of samples of cottonseed meal, linseed meal, gluten meal, gluten feed, meat scrap, fish meal, bone meal, hominy feed, oat hulls, dried beet pulp, wheat bran, red dog flour, wheat middlings, wheat mixed feed, and the usual proprietary stock and poultry feeds.

Third annual report of the division of feed inspection for the year 1921, H. A. HALVORSON (*Minn. State Dairy and Food Comn., Div. Feed Insp. Ann. Rpt.*, 3 (1921), pp. 169).—In this report the author explains the Minnesota feed law and gives the definitions of feeding stuffs as adopted by the Association of Feed Control Officials of the United States.

The estimated amount and value of feeds sold for consumption in Minnesota during 1921 are given in a table, as well as the feeds which were removed from sale because of improper labeling. The guaranteed and found analyses of the 1,207 samples of feed analyzed by the inspector are reported in tabular form. These feeds include wheat middlings with and without ground screenings, wheat bran with and without ground screenings, flour wheat middlings with and without ground screenings, red dog flour, wheat mixed feed, rye middlings with and without ground screenings, ground barley, malt sprouts, barley feed, gluten feed, hominy feed, linseed oil meal, ground linseed cake, cottonseed meal, cottonseed feed, cottonseed cake, alfalfa meal, dried beet pulp, meat scrap, fish meal, tankage, ground oat hulls, oat middlings, ground oil cake meal, flaxseed, alfalfa hay, and distillers' dried grains, as well as the usual proprietary stock and poultry feeds.

Food animals and meat consumption in the United States, J. ROBERTS (*U. S. Dept. Agr., Dept. Circ.* 241 (1922), pp. 19, figs. 8).—Data are presented to show the gradual increases which have occurred in the human population from 1850 to 1922 as compared with the cattle, sheep, and hog populations which have remained more nearly constant since 1885 or 1895 for the different classes of meat animals. This has been accompanied by a reduction in the per capita consumption of meat from 170.9 lbs. in 1908 to a low point of 131.8 lbs. in 1917, and which has irregularly increased to 144.9 lbs. in 1921.

The number of purebred animals in the United States by States, the monthly ratio of births to animals slaughtered, and the foreign trade in meat are discussed and presented in tabular and graphical form.

[**Beef cattle feeding experiments at the North Dakota Station**] (*North Dakota Sta. Bul. 159 (1922)*, pp. 11, 12, 15-19).—Trials in determining the carrying capacity of the native range grasses of North Dakota gave practically the same results as were obtained in 1919 (*E. S. R.*, 45, p. 267).

Sixty-one 2-year-old steers, mostly from the above trials, were started on a 56-day feeding trial in early November. At the end of the trial they were fed for 18 days on sunflower and corn silage, mixed in the proportion of 4:3, followed by 18 days' feeding on corn silage. The respective daily gains made were 1.54, 1.3, and 1.1 lbs. per steer. Roughages in the form of low-grade alfalfa hay, sweet clover hay, and coarse timothy hay were fed; also brown hay made from sweet clover and 2.5 lbs. of a grain mixture of 1 part oil meal and 4 parts corn meal per head per day. Results on the shrinkage of some of the short-fed steers showed that the shrinkage was heavier than on fat steers, averages of 7 and 5.8 per cent, respectively, being reported.

[**Nutritional studies of hay from native prairie grasses and Russian thistle silage**] (*North Dakota Sta. Bul. 159 (1922)*, pp. 24, 25).—Cuttings were made in April, 1920, of hay from native prairie grasses that had wintered over, in July from prairie that had been cut the previous fall, and in October of the mature growth, including that which had remained from the previous year. Digestion trials were made on the cuttings with four steers. The July cutting was from 12 to 15 per cent more digestible than the other cuttings. The cattle would not eat enough of the April cutting to maintain weight.

In two samples of Russian thistle silage which were analyzed the dry matter was 21.75 and the ash 21.12 per cent. The dry matter contained 14.54 per cent of protein, 3.59 of fat, 28.38 of crude fiber, and 32.34 per cent of nitrogen-free extract.

Comparison of shelled corn, rice meal, and velvet beans for fattening steers, L. V. STARKEY and W. D. SALMON (*South Carolina Sta. Bul. 214 (1922)*, pp. 8, fig. 1).—To compare shelled corn with rice meal, and velvet beans and shelled corn with cottonseed meal and shelled corn, and to determine the economy of using whole velvet beans as the sole concentrate for fattening steers, 4 lots, each consisting of 6 2-year-old grade Shorthorn steers, were selected for a 119-day feeding period. All lots were fed as much corn silage as they would consume and a little cowpea hay, with the addition of shelled corn and cottonseed meal in lot 1, rice meal and cottonseed meal in lot 2, whole velvet beans in lot 3, and whole velvet beans and shelled corn in lot 4. Enough hogs to clean up the waste grain followed the steers in each lot. The following table gives a summary of the comparative efficiency of the different rations:

Gains and feed consumed by 2-year-old steers on the comparative rations.

Lot.	Average initial weight.	Average daily gain.	Average daily feed per steer						Concentrates consumed per 100 pounds gain	Feed cost per 100 pounds gain.	Pork produced.
			Corn silage.	Cowpea hay	Shelled corn.	Rice meal	Cottonseed meal.	Whole velvet beans			
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		Lbs.
1	1,002.16	2.37	41.18	1.13	9.25		3.22		526.49	\$13.57	257
2	999.10	2.22	40.55	1.13		9.14	3.22		557.72	14.86	12
3	997.33	1.96	34.10	1.13				13.19	671.07	10.63	27
4	998.44	2.08	34.40	1.13	3.93			10.00	669.16	11.41	90

Steers in all lots were sold at the same price per pound at the conclusion of the test.

Analyses of the feeds used are reported.

Sunflower silage for steers; smutted corn silage for cows, J. W. WILSON and A. H. KUHLMAN (*South Dakota Sta. Bul. 199* (1922), pp. 471-481).—Experiments in feeding sunflower silage and oil meal to a lot of 4 2-year-old steers and corn silage and oil meal to another lot from January 6 to March 6, 1920, showed average gains per steer for the respective lots of 52 and 164 lbs. In the second series of experiments 5 lots of yearling steers were fed from October 21 to December 20, 1921, making respective gains per steer of 76, 69, 47, 10, and -42 lbs., on rations of corn silage alone, $\frac{3}{4}$ corn silage and $\frac{1}{4}$ sunflower silage, $\frac{1}{2}$ corn silage and $\frac{1}{2}$ sunflower silage, $\frac{1}{4}$ corn silage and $\frac{3}{4}$ sunflower silage, and sunflower silage alone.

The conclusions drawn from this experiment are that if corn can be grown sunflowers should not be used for silage. It is stated that the steers would not eat as much of the sunflower silage as corn silage during either of the experiments.

Corn plants, on which ears were growing and which were more or less smutted, were chopped and packed in a barrel and later fed to four pregnant cows at the rate of 2 to 5 lbs. daily for 26 days without bad results. One cow calved 22 days after stopping the feed and the calf was weak and died, but this was not attributed to the smut feeding. No bad results have occurred from feeding silage made from smutted corn to the regular herd.

A method of determining grease and dirt in wool, D. A. SPENCER, J. I. HARDY, and M. J. BRANDON (*U. S. Dept. Bul. 1100* (1922), pp. 20, figs. 6).—Methods of determining the grease and dirt content of fleeces from individual sheep have been worked out as a result of investigations carried on at Beltsville, Md. The samples as they are received are stored in a dry room until ready for testing. The method consists in placing a sample of approximately 250 gm. in a weighed wire mesh basket, after which it is heated in an oven for three hours at 50° C. to a constant moisture content and weighed in the oven. It is then washed three times with deodorized gasoline for 45 minutes each time and filtered after each washing. The sample is then air dried, after which it is dried in the 50° oven for three hours and weighed, including the dirt collected on the filter paper.

The difference between this and the original weight is due to the grease which has been washed out by the gasoline. The sample is next washed with soap and water at 40 to 45° for 45 minutes, then with clear water for 30 minutes at the same temperature. In case the wool is very dirty, a third washing may be necessary. The difference in weight after drying for three hours in the oven and the previous weight after washing with gasoline is due to the dirt removed. The dirt and grease content should be stated as percentage, based on the weight of the cleaned wool. The results of analyses of a number of samples of wool are given, as well as samples of the sheets on which the data are recorded.

Thirty-third annual wool review, WINCHCOMBE, CARSON, LTD. (*Sydney: [Authors], 1922, pp. 36*).—This gives a review of the wool market of Sydney and Brisbane, Australia, with discussions of the wool conditions in Australia.

Reindeer in Alaska, S. HADWEN and L. J. PALMER (*U. S. Dept. Agr. Bul. 1089* (1922), pp. 74, pls. 24, figs. 2).—This bulletin consists mainly of a descrip-

tion of the reindeer and reindeer management in Alaska. There are from 180,000 to 200,000 reindeer now in Alaska which have originated from an importation of 1,280 animals from Siberia, beginning in 1892. The reindeer are used mainly for the production of meat for food and skins for clothing, though some are used as beasts of burden. It is estimated that about two-thirds of the reindeer are owned by Eskimos and the rest by white men and Lapps. In general the animals are given little care and no feeding is done.

The herds consist of from 400 to 5,000 head, which are kept together by the herders and are rounded up from time to time on the range, when certain animals are roped for marking, killing, etc., during which time great losses often occur, due to trampling, falling, breaking horns, and poor feeding conditions. The process is also very slow. The use of conveniently arranged corrals is suggested as being much quicker and the losses are not so great. It is estimated that the yearly range requirement for each animal is about 30 acres, but the best practice seems to be in grazing along the coast in the summer on herbaceous plants and retreating to the more protected areas of the interior during the winter where the grazing is mostly on moss and lichens.

The rutting season in the reindeer extends from the last of August to October. The gestation period is about 7 months and 7 days, making the fawning season commence in April. Considerable attention is called to the advisability of improving the rather crude methods of management now practiced. Better methods of slaughtering and storing of the carcasses would also be of great advantage. Killing of the steers for meat should be done in the fall and the meat preserved by natural cold storage, as the animals are in much better condition at that time of the year.

A discussion is also given of the losses which occur from predatory animals, injuries, diseases, and parasites, as well as a list of Alaska range plants.

Hog feeding experiments, H. HACKBORN and J. SOTOLA (*Washington Col. Sta. Bul.* 169 (1922), pp. 32, figs. 2) —In a series of hog feeding tests carried on from 1918 to 1922, part of which have been previously referred to (*E. S. R.*, 47, p. 575), 20 lots of purebred Duroc-Jersey and Poland China hogs were used. While all the lots were not fed at the time and are not strictly comparable from that viewpoint, lots 1 to 6, including 1A and 2A, were used to compare tankage containing 60 per cent protein and fish meal containing 56 per cent protein as supplements to 3 parts rolled barley and 1 part mill-run (consisting of bran, shorts, and middlings finely ground together) in dry lot and on pea and alfalfa pasture; lots 7 to 9 to determine the advisability of using coconut meal containing 21.5 per cent protein to replace tankage, fish meal, or mill-run in a similar ration; lots 1, 10, 3, and 11 to study the possibility of replacing part of the barley with cane molasses in dry lot and on pea forage; lots 1, 3, 2, 4, 12, 5, 13, and 6 to compare fattening in dry lot with fattening on pea forage, using the same feeds; and lots 14 to 18 to study the possibilities of using linseed meal, both alone and in mixtures with tankage and fish meal as a protein supplement to barley and mill-run. It was planned that the hogs on forage should be given approximately one-half the amount of feed fed the corresponding pigs in dry lot. All grain was fed in a thick slop twice daily. A mineral mixture consisting of bone meal, air-slaked lime, and salt in the proportions of 5:4:1 by weight was self-

fed during 1921-22 to the lots marked with footnotes. The following table gives a summary of the results of the tests:

Summary of hog feeding tests with tankage, fish meal, linseed meal, coconut meal, and cane molasses.

Lot.	Conditions of feeding.	Number of pigs	Length of test	Average initial weight.	Average daily gain per pig.	Feed required to produce 100 pounds gain.								Total.
						Barley.	Mill-run	Tank-age.	Fish meal.	Coco-nut meal	Lin-seed meal	Cane mo-lasses.		
		No	Days	Lbs	Lbs	Lbs	Lbs	Lbs	Lbs.	Lbs.	Lbs	Lbs.	Lbs.	
1	Dry lot.....	14	57	69.6	1.3	208	99	44					441	
2	do.....	14	57	68.6	1.4	278	93		41				412	
1A	do.....	12	110	50.2	1.1	287	96	54					¹ 439	
2A	do.....	12	110	51.2	1.1	289	96		46				² 432	
3	Pea forage.....	17	74	65.5	1.1	194	64	27					285	
4	do.....	18	74	66.4	1.1	197	66		25				287	
5	Alfalfa pasture.....	7	65	40.8	.8	208	70	42					320	
6	do.....	7	65	40.8	.8	209	69		40				318	
7	Dry lot.....	6	60	45.5	.5	176	58			206			440	
8	do.....	14	74	66.6	1.4	286		37		95			418	
9	do.....	15	74	68.6	1.4	303	101		39				443	
10	do.....	14	74	65.8	1.1	207	116	45					596	
11	Pea forage.....	8	74	65.7	1.1	84	54	23				228	90	
12	Dry lot.....	14	30	69.7	1.3	253	85	43					381	
13	do.....	14	30	68.6	1.3	255	85		44				384	
14	do.....	12	110	50.2	1.1	287	96	54					¹ 439	
15	do.....	12	110	51.2	1.1	289	96		46				² 432	
16	do.....	12	110	50.0	.9	315	105				81		³ 502	
17	do.....	11	110	51.3	1.0	306	102	34			34		⁴ 476	
18	do.....	7	110	58.6	1.3	338	112		23		23		⁵ 499	

¹ Includes 1.9 lbs. minerals

² Includes 1.1 lbs. minerals.

³ Includes 0.43 lb. minerals.

⁴ Includes 1.2 lbs. minerals

⁵ Includes 2.3 lbs. minerals

The authors' general conclusions are that tankage and fish meal were about equal in feeding value, as are also mill-run and coconut meal. Neither coconut meal nor linseed meal was a satisfactory substitute for tankage or fish meal. Cane molasses was an efficient substitute for one-half the barley, pound for pound, on pea forage, but did not prove so efficient in the dry lot, and the grain saved on pea forage was approximately equal to the yield of peas.

[Hogging off field peas and corn], O. A. THOMPSON (*North Dakota Sta. Bul. 161 (1922), pp. 3-5*).—On July 29, 1921, 97 pigs were turned on 9.39 acres of ripe field peas for 30 days, during which time they gained 3,265 lbs., or at the rate of \$21.73 per acre. After being taken off the peas the pigs were pastured on 6.8 acres of Dakota white flint corn for 19 days, during which time they gained 3,170 lbs., giving a return of \$29.14 per acre. These pigs were finished on 327 bu. of shelled corn in a self-feeder for 20 days, during which time they gained 3,800 lbs. at a cost of 3.4 cts. per pound, based on corn worth 40 cts. per bushel. At first the pigs were allowed to become gradually accustomed to the field peas and corn.

Hogging off corn (*North Dakota Sta. Bul. 159 (1922), pp. 12, 15*).—Eighty-one Poland China, Berkshire, Duroc-Jersey, Chester White, and Yorkshire shotes averaging 105.5 lbs., turned on September 10, 1920, into 18 acres of Dakota corn yielding 32 bu. per acre made average daily gains of 1.6 lbs. until November 23. During the test the hogs consumed daily 0.46 lb. of tankage and 0.2 lb. of shorts per head.

A new experiment on hogging down corn, E. F. FERRIN and L. J. JESSUP (*Chester White Jour., 13 (1922), No. 5, p. 17*).—An experiment in hogging down

corn is reported from the Minnesota Experiment Station in which 3 lots of 15 hogs each were fed as follows: Lot 1 self-fed ear corn in dry lot, lot 2 allowed 1 acre of standing corn with estimated yield of 62.85 bu., and lot 3 allowed 1 acre of standing corn with estimated yield of 57.57 bu., with rape sown in at the last cultivation. All lots received tankage self-fed. The results of the test are best shown in the following table:

Weights, gains, and feed consumed in hogging down corn.

Lot.	Kind of feed.	Days on experiment.	Average initial weight	Average final weight	Average daily gain.	Estimated feed consumed per 100 lbs. gain.	Estimated cost per 100 lbs. gain. ¹
			<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	
1	Ear corn, self-fed in dry lot..	37	142 4	204	1.48	583	\$3.09
2	Standing corn	37	142.4	192.5	1.36	607.1	2.59
3	Standing corn and rape	31	112 7	188 6	1.48	608.5	2 58

¹ Corn in field at 25 cts per bushel, corn in crib at 31 cts per bushel, tankage at \$52.50 per ton.

The systematic folding of pigs on arable land, A HARBORD (*Jour. Bath and West and South Counties Soc.*, 5. ser., 16 (1921-22), pp. 22-30, pls. 2).—This is an account of the pasturing of 2 lots of hogs, mostly sows and gilts, on swedes, kale, rape, red clover, and rye grass at the Friningham Hardy Stock Farm during 1921

The relation of the fat-soluble factor to rickets and growth in pigs, II, J. GOLDING, S. S. ZILVA, J. C. DRUMMOND, and K. H. COWARD (*Biochem. Jour.*, 16 (1922), No. 3, pp. 394-402, pl. 1, fig. 1).—In continuing the studies (E. S. R., 46, p. 64) on the relation of vitamin A to rickets and growth in pigs, a study was made to determine the relation of calcium with the lack of vitamin A to the production of rickets.

A gilt was given a diet of toppings and whey (deficient in vitamin A) from weaning to 7 months of age, during which time growth was retarded. By supplementing this diet with alfalfa for 74 days the gilt resumed growth. At 9½ months of age she was bred and fed a diet of toppings, whey, and swedes while carrying the pigs and while the pigs were sucking. One dead and 8 living pigs were farrowed, which were divided into four lots of 2 each.

Lots 2 and 1 were to receive diets deficient in vitamin A with and without calcium, whereas lots 4 and 3 received vitamin A in the form of cod liver oil, both while sucking the sow and after weaning, and with and without calcium, respectively. Due to the very bad condition of lots 1 and 2, it was found advisable to modify this scheme somewhat during some of the feeding periods, as shown in the table below. After weaning, the pigs were all put on a basal diet of toppings (containing 0.338 per cent calcium) and caseinogen (heated for 24 hours at 120° C. for vitamin-free diets), 7 cc. of fresh lemon juice, and ½ oz. of marmite (commercial yeast extract). Lots 1 and 2 received olive oil in place of the cod liver oil given to lots 3 and 4.

Daily doses of 1 oz. of precipitated chalk and 1 oz. of animal charcoal containing 67.3 per cent calcium phosphate were given to the pigs in lots 2 and 4, whereas all the calcium which was given to lots 1 and 3 consisted of the 0.338 per cent which was in the toppings; therefore the latter diets were deficient in calcium. The following table shows the gains made by the pigs during the

different periods, as well as the presence or absence of vitamin A and calcium in the rations:

Gains made by pigs on rations with and without vitamin A and calcium.

Period	Days	Lot 1.				Lot 2.			
		Presence or absence of vitamin A and calcium.	Total gain.		Presence or absence of vitamin A and calcium.	Total gain.			
			I	II		I	II		
1	53	-Vit. A-Ca...	Lbs. 26 50	Lbs. 27 25	-Vit. A+Ca...	Lbs. 20 00	Lbs. 28 25		
2	54	-Vit. A-Ca...	20 88	21 00	-Vit. A+Ca...	23 50	25 50		
3	35	-Vit. A-Ca...	4 62	1 25	-Vit. A+Ca...	13 00	15 75		
4	22	+Vit. A ¹ -Ca...	10 25		+Vit. A ¹ +Ca...	9 25	9 75		
5(a)	7	-Vit. A-Ca...	-0 50		-Vit. A+Ca...	1 75	0 50		
5(b)	3	+Vit. A ² -Ca...	4 25		+Vit. A ² +Ca...	1 50	4 50		
5(c)	20	-Vit. A-Ca...	7 25		-Vit. A+Ca...	9 25	6 50		

Period	Days	Lot 3				Lot 4.			
		Presence or absence of vitamin A and calcium.	Total gain		Presence or absence of vitamin A and calcium	Total gain.			
			I	II		I	II		
1	53	+Vit. A-Ca...	Lbs. 25 50	Lbs. 24 00	+Vit. A+Ca...	Lbs. 18 25	Lbs. 27 00		
2	54	+Vit. A-Ca...	34 625	28 06	+Vit. A+Ca...	34 025	40 00		
3	35	+Vit. A-Ca...	21 60	20 40	+Vit. A+Ca...	29 40	29 00		
4	22	+Vit. A-Ca...	23 50	18 25	+Vit. A+Ca...	31 50	30 25		
5(a)	7	+Vit. A-Ca...	6 00	6 25	+Vit. A+Ca...	8 50	12 75		
5(b)	3	+Vit. A-Ca...	1 75	1 50	+Vit. A+Ca...	5 00	3 50		
5(c)	20	+Vit. A ¹ -Ca...	19 50	18 25	+Vit. A ¹ +Ca...	32 00	21 50		

¹ Died at end of 26 days with broken back.

² Caseinogen unheated as only source of vitamin A.

³ During period 5(c) no oil was given, but lots 3 and 4 received unheated caseinogen as in other periods.

The table indicates that during period 1, even though the sow had been fed for some months on a diet deficient in fat-soluble A, she was able to raise her pigs satisfactorily, as no particular advantage in growth was shown by those pigs receiving supplements of cod liver oil. During period 2 the animals in lots 1 and 2 not only gained less in weight, but at the end of this period the pigs in lot 1 developed a scurfy skin, saddle back, weak legs, and joints painful to pressure. The animals of lot 2 showed a lack of vitality and saddle backs. Lots 3 and 4 were in good condition.

At the end of the experiments the animals were described as "lots 1 and 2, wrinkled skin, ears carried forward, down on hind legs; lot 3, skin rather rough, lack of size and bloom, flesh not quite firm, otherwise normal; and lot 4, skin healthy and animals perfectly normal."

The animals slaughtered showed that the ribs were more easily broken and the fat was softer in the pigs of lots 1 and 2. Histological examinations of the ribs showed the presence of more or less osteoporosis in the pigs from all lots, but it was more pronounced in lots 1 and 2. The features of the results were that while the feeds of the pigs in lots 1 and 2 were deficient in vitamin A and calcium (in lot 1) and growth was very poor, the condition of the pigs in the pathological sense could not be defined as rickets, and the fact that the pigs in lot 4 showed some osteoporosis, which may have been due to the deficient diet of the sow.

The Large White pig, S. SPENCER (*Jour. Min. Agr. [London]*, 29 (1922), No. 3, pp. 275-279, pl. 1).—A brief description of the difficulties encountered in

the development of Large White pigs is given, as well as a description of the more desirable type.

A study of digestive actions, B. F. KAUPP (*Poultry Item*, 24 (1922), No. 9, pp. 10, 14, 15, 26, 27).—Data are given, based on tests with 23 2- and 3-year-old hens and 2 broilers, showing the length of time required for food to pass through the digestive tract of growing hens, broody hens, hens laying, and not laying. To make the determinations as to when a feed passed through the birds, lamp black, methylene blue, and gentian violet were used on the feeds. The average time required for food to pass through laying hens was 3 hours and 46 minutes, broilers 3 hours and 52 minutes, adult hens not laying 8 hours, and broody hens 11 hours and 44 minutes. Gentian violet and methylene blue exercised an unnatural influence on the intestinal tract, and the results with them had to be considered inaccurate.

Poultry feeding experiment, A. V. D. RINTOUL and W. C. RUGG (*Jour. Dept. Agr. Victoria*, 19 (1921), No. 4, pp. 247-249).—A poultry feeding test, carried on at the Werribee Research Farm, Victoria, from March 1 to December 31, 1920, is reported in which 3 lots of 40 White Leghorn pullets each were fed as follows: Lot 1 wet mash in the morning and grain at night, lot 2 grain in the morning and wet mash at night, and lot 3 dry mash self-fed and grain at night. All lots received chaffed green stuff at noon. The wet mash consisted of equal amounts by volume of bran, pollard, and chopped green stuff moistened with a soup made of boiled beef scrap, sheep's heads, livers, etc. The dry mash consisted of equal parts by volume of bran and pollard, with about 10 per cent meat meal added. The green stuff consisted of green oats, barley, rye grass, and alfalfa cut fresh and put through the chaff cutter. The grain consisted of wheat with the occasional addition of barley.

During the 10 months pens 1 and 2 each consumed 1,530 lbs. of wet mash, 1,224 lbs. of chaffed green stuff, and 1,377 lbs. of grain, and laid, respectively, 6,244 and 5,988 eggs. Pen 3 consumed 290 lbs. of bran, 585 lbs. of pollard, 105 lbs. of meat meal, 1,224 lbs. of chaffed green stuff, and 1,377 lbs. of grain, and laid 5,989 eggs. A severe outbreak of chicken pox occurred during the test, as well as a very hot spell near the end, 3, 6, and 1 birds being lost, respectively, in pens 1, 2, and 3 during this time.

Poultry feeding experiment, A. V. D. RINTOUL and W. C. RUGG (*Jour. Dept. Agr. Victoria*, 20 (1922), No. 4, pp. 244-247).—In a poultry feeding experiment at the Werribee Research Farm, 4 lots of 30 pullets each were placed on a feeding test from April 1, 1921, to March 31, 1922. All lots were fed a wet mash of equal parts of bran, pollard, and green stuff in the morning and green feed composed of alfalfa, barley, rye grass, and leaves of vegetables at noon. At night each pen received a different grain feed as shown in the following table, which gives a summary of the results:

Summary of the weights, eggs laid, cost of grain, and mortality of pullets on different grain feeds.

Pen No.	Grain.	Average weight per bird.		Average eggs per bird.	Cost of grain fed.		Mortality.
		Apr. 1, 1921.	Mar. 31, 1922.				
		Lbs. oz.	Lbs. oz.		s.	d.	
1	Algerian oats.....	2 12	3 4½	170	3	9½	10
2	Wheat.....	2 12	3 9½	150½	6	7½	8
3	Barley.....	2 12	3 10	144½	3	3½	9
4	Two parts wheat, 1 part oats, and 1 part barley.	2 12	3 8½	157½	4	6½	6

The author's conclusions were that Algerian oats is a thoroughly satisfactory feed. It was further noted that while barley gave the poorest total egg yield, the birds on this feed laid well when eggs were highest in price.

Feeding the laying flocks, W. C. THOMPSON (*New Jersey Stas. Hints to Poultrymen*, 10 (1922), No. 12, pp. 4).—The ingredients of the New Jersey standard scratch ration and dry mash are given, as well as directions for feeding them to the laying flock to get good results.

[**North Dakota egg-laying contest**] (*North Dakota Sta. Bul.* 159 (1922), p. 33).—Twelve pens of five pullets each were entered in the egg-laying contest at the station from November, 1919, to October 31, 1920, during which time their average yearly egg production was 105.5 eggs. Based on feed and egg prices, it cost an average of 54.6 eggs to pay the feed costs.

The correlation between the monthly record of the first year and the annual record of the second year, with special reference to culling for second year production, J. A. HARRIS and H. R. LEWIS (*Poultry Sci.*, 1 (1922), No. 5, pp. 145-150).—In treating the same data analyzed in a previous article (E. S. R., 47, p. 662), but using the monthly egg production of the first year as a basis for calculating the second year's egg production, the authors find that by dividing the monthly production during the first year into quartiles, as in previous work (E. S. R., 40, p. 876), the second year's egg productions are almost universally higher for these birds that fall in the higher monthly quartiles.

Preliminary report of the secretary of the American Record of Performance Council, W. C. THOMPSON (*Poultry Sci.*, 1 (1922), No. 5, pp. 163-166).—This includes an outline of the purpose of the American Record of Performance Council, with requirements for the certification of birds and a list of the egg-laying contests in the United States and Canada which are members of the council.

DAIRY FARMING—DAIRYING.

Growth studies of dairy heifers.—Effect of light and heavy feeding of wide and narrow rations (*Nebraska Sta. Bul.* 181 (1922), pp. 3-23, figs. 6).—To study the relative rates of growth as determined by height at withers and weight in dairy heifers receiving light and heavy feeds of wide and narrow rations, four groups of 2 Holstein and 2 Jersey heifers each were selected.

The wide ration consisted of alfalfa hay fed ad libitum and ground corn given to the heavy fed lot at the rate of 2 lbs. per day for the first 200 lbs. live weight and 1 lb. additional for each 100 lbs. of gain to a maximum of 6 lbs. per day and to the light fed lot in one-half these amounts. The narrow ration consisted of alfalfa hay fed ad libitum and a grain mixture of 5 parts ground corn, 2 parts wheat bran, and 2 parts linseed oil meal fed in the same proportion with the heavy and light fed lots as the corn in the wide ration. All calves received whole milk until 2 weeks of age, after which skim milk was fed until 6 months of age, supplemented by grain and hay.

Average monthly weights and heights are recorded in tabular form for each group, and graphs are given showing the growth in each case which is compared with the growth records for each breed as reported by Eckles (E. S. R., 43, p. 876). The average gains in height from 2 months to 27 months of age by the Holsteins and Jerseys, respectively, on the wide ration with heavy feeding were 54.4 and 56.6 cm. and with light feeding 49.9 and 51.4 cm., and on the narrow ration with heavy feeding were 57.3 and 47.8 cm. and with light feeding 45.9 and 48.2 cm. The average total gains in weight for the Holstein and Jersey calves on the above rations from birth to 24 months of age were,

respectively, 1,028.5 and 795, 843.5 and 724, 1,036 and 774, and 873.5 and 717 lbs. The Holstein heifers showed their greatest gain in height between the ages of 4 and 8 months and the Jerseys between 2 and 6 months.

The heavy feeding of the corn appeared to produce practically as much gain in weight as the mixed feed, but light feeding of the corn was not as good as light feeding of the mixed feed. The liberal fed Holsteins were approximately 150 lbs. heavier and the Jerseys 50 lbs. heavier at 2 years of age than the lighter fed ones. Liberal feeding during the first 6 months while skim milk was fed appeared to have no advantage over light feeding, at least in the production of gain in weight.

A comparison of early, medium, and late maturing varieties of silage corn for milk production. G. C. WHITE and L. M. CHAPMAN (*Jour. Dairy Sci.*, 5 (1922), No. 4, pp. 333-347, fig. 1).—A preliminary report is given of the first year's work at the Connecticut Storrs Experiment Station to determine the value per ton and per acre of early (Pride of the North), medium (Leaming), and late (Eureka) corn silage for milk production. The corn for this experiment was planted on May 28, 1920, and harvested on October 4, being put in separate silos especially constructed for the purpose. The average dry matter of the different silages as fed was 25.7, 25.2, and 19.4 per cent, respectively, for the early, medium and late silages. In determining the feeding value of the silage, three lots of four cows (one in each lot discarded) each were selected to be fed for 100 days on one type of silage, together with a basal ration of mixed hay and a grain mixture of 3 parts of corn meal, 3 parts of wheat bran, and 2 parts of cottonseed meal. One of the cows in each lot received 40 lbs. of silage per day, and the rest received 50 lbs. Each cow received 4 lbs. of hay per day. The amount of grain was determined by the daily weight of the animals, enough being fed to just maintain weight.

The average daily milk and fat produced were, respectively, for the cows on early, medium, and late silage 28.3 and 1.09, 22.9 and 1.05, and 29.2 and 1.03 lbs. The average gain in weight per cow during the test was 17.67, 2.33, and -14 lbs., respectively, for the different groups. The milk-producing value of the early and medium silage was found to be practically the same, since 35.4 and 35.8 lbs. of grain were required per 100 lbs. of milk produced, but 39.8 lbs. of grain was required by the late silage group.

The yields in green weight of the different silages were on a percentage basis 100, 133, and 167 per cent for the early, medium, and late silage, and on a dry-matter basis 100, 111, and 123, respectively. It is stated that discussion will be given of the milk-producing value per acre when more data are available.

Silage for milk production: A comparison with roots and hay. R. G. WHITE and E. J. ROBERTS (*Jour. Min. Agr. [London]*, 29 (1922), No. 1, 34-37).—An experiment under the direction of the University College of North Wales is reported in which two lots of eight cows each on neighboring farms were fed by the reversal method for two-week periods on the following daily rations designated as the silage ration and the root ration: The silage ration, 40 lbs. of oat and pea silage, 6 lbs. of seed hay, and 8 lbs. of mangels; root ration, 40 lbs. of mangels and 15 lbs. of seed hay, with the addition to each ration of 4 lbs. of oat straw, 2 lbs. of peanut cake, 3 lbs. of soy bean cake, 1.5 lbs. of oats, and 1 lb. of barley. During the first period there was very little difference between the milk produced by the silage and root rations, but during the second period 313 lbs. more milk was produced by the silage ration.

The silage used in this experiment was packed in a shallow pit by having the wagons drive over it, and dirt was heaped up around the edges. At the time of opening, the material at the top and sides had rotted to a depth of about 9 in. The analysis of the silage was given as 76.6 per cent of moisture,

3.5 per cent of crude protein, 1.05 per cent of fat, 9.15 per cent of fiber, 2.3 per cent of ash, and 7.4 per cent of soluble carbohydrates.

[Corn and sunflower silage for dairy cattle] (*North Dakota Sta. Bul.* 159 (1922), pp. 25, 26).—Four cows and six helpers fed in tests to compare corn silage with corn and sunflower silage and with sunflower silage indicate that the silages were of equal value for milk and fat production and for maintaining weight, but the corn silage was preferred by the cattle.

The cost of manual labor in milk production, A. G. RUSTON and R. S. SETON (*Jour. Min. Agr.* [London], 29 (1922), No. 5, pp. 411-419, pls. 2).—Cost account records kept on 22 Yorkshire dairy herds during 1919-20 under the direction of the University of Leeds showed that it required all of one man's time to care for from 14 to 29 cows in the summer months and from 10 to 16 cows in the winter months, with an average of 23 days of man labor required to care for one cow per year.

Influence of purebred dairy sires, T. M. OLSON and G. C. BIGGAB (*South Dakota Sta. Bul.* 198 (1922), pp. 433-466, figs. 33).—The results of an experiment started in 1907 to study the improvement which was brought about in milk production and dairy conformation in successive generations by crossing purebred Holstein, Jersey, and Guernsey bulls on three grade beef cows and their offspring are reported. The production of the first and second crosses has now shown marked improvement in both fat and milk except in one instance in each generation which is attributed to the fact that the purebred bull used was inferior. The animals produced in the third and fourth crosses have been so markedly improved that they are usually not to be distinguished from purebreds in color or type.

An examination of certain milk records, G. W. MONIER-WILLIAMS (*Analyst*, 45 (1920), No. 531, pp. 203-218, figs. 14).—The butter-fat content of 4,825 samples of morning and evening milk from individual cows in different periods of lactation has been treated statistically, and curves have been plotted from these results. The effects of different intervals between milkings have also been studied from another set of samples with relation to variation in butter fat percentage. Discussions of these results are also included.

The Friesian Herdbook Association, N. H. BLINK (*Holstein-Friesian World*, 19 (1922), No. 28, pp. 2033-2035, figs. 10).—This is an account of the methods used by the Friesian Herdbook Association (Friesch Rundvee Stamboek) in recording cattle. Outstanding features of the system are the strict rules requiring the almost immediate reporting of calves born, the eligibility of animals to registry only after they are partially matured and have been passed upon by judges, and the care with which the milk records are kept and recorded.

Milk testing in practice, H. M. JONES and T. H. WRIGHT (*South Dakota Sta. Bul.* 197 (1922), pp. 418-431, figs. 12).—This bulletin deals with the practical advantages which result from testing individual cows in the herd. Systems of testing, a description of the Babcock test, and methods of keeping records are described.

Report of the steward of dairying, Derby Show, 1921, E. MATHEWS (*Jour. Roy. Agr. Soc. England*, 82 (1921), pp. 194-208).—An account is given of the trials for milk yield, butter tests, demonstration of dairying experiments and the bromo-cresol purple test, and methods of churning which were carried on at the 1921 Derby Show.

The stage of lactation as a factor in the variation of the per cent of fat in cow's milk, A. C. RAGSDALE and C. W. TURNER (*Jour. Dairy Sci.*, 5 (1922), No. 1, pp. 22-26, fig. 1).—Data collected on 3,763 Guernseys from advanced register tests, 299 Jerseys from the American Jersey Cattle Club, and 95 Hol-

steins from records of the herd at the Missouri Experiment Station showed that there was a distinct variation of the fat percentage of cows, dependent upon the stage of lactation. The first month's milk was found to be high in fat, followed for from one to three months by gradual reductions in fat percentage, which then began to increase until the last month of lactation.

Evidence of the necessity for a bacteriological standard for grade "A" milk, A. T. R. MATTHEW and R. S. WILLIAMS (*Jour. Hyg. [London]*, 21 (1922), No. 1, pp. 33-36).—The results of bacteriological studies of 147 samples of grade "A" milk from two farms are reported and compared with the bacterial counts of samples of grade "A" (certified) milk from farms 1 and 4 previously noted (E. S. R., 46, p. 176). The fact that the bacterial counts of a large percentage of these samples of grade "A" milk ran over 30,000 per cubic centimeter indicates the importance of establishing a standard bacterial count for grade "A" milk.

Studies in the control of a municipal milk supply, I. V. HISCOCK (*Jour. Dairy Sci.*, 5 (1922), No. 1, pp. 83-96).—This is a discussion of the relation between the bacterial count of milk collected from several dairies and the score of the respective dairy, the amount of dirt in the milk, and the temperature of the day and the milk at delivery. It is concluded that in general the dairies with the better scores produced higher quality milk, but there were marked exceptions to this. The importance of sampling both the morning and evening milk at milk plants is suggested, since more or less variation was found in the bacterial counts of each.

The effect of silage on the flavor and odor of milk, J. A. GAMBLE and E. KELLY (*U. S. Dept. Agr. Bul.* 1097 (1922), pp. 24, fig. 1).—This series of experiments was performed to determine whether silage affects the flavor and odor of milk and cream and how silage may best be fed to minimize this effect on the quality of the milk. The cows were milked in a nonventilated barn contaminated with corn-silage odor and in a well-ventilated barn one hour before and in other cases one hour after feeding varying amounts of corn, alfalfa, sweet clover, and soy-bean silage. The milk was examined for silage flavors and odors by a corps of experts.

As a result of the tests it may be concluded that the taint of silage fed one hour before milking is usually discernable in the milk, especially in the case of the legume silages or where large amounts of corn silage are fed. Not over 15 to 25 lbs. of corn silage or 15 lbs. of legume silage could be fed twice daily after milking without being noticeable in the milk. In properly ventilated barns most of the odor and flavor imparted to the milk is due to the silage eaten. Aeration of the warm milk was found to markedly reduce silage odors and flavors. Condensed milk was found to carry less of the taint than the milk from which it was made. Spoiled silage and the legume silages were found to be more liable to affect the milk than equal amounts of corn silage. So much variation was noted in the flavor of milk from different cows that a slight silage flavor was found in some cases to really improve the quality of the milk.

Practical suggestions for sterilizing milking machine tubes, J. D. LUCKETT (*New York State Sta. Bul.* 492, pop. ed. (1922), pp. 8).—This is a popular edition of the bulletin previously noted (E. S. R., 47, p. 480).

Laboratory supervision of pasteurization plants, I. V. HISCOCK (*Jour. Dairy Sci.*, 5 (1922), No. 4, pp. 372-376).—This is a discussion of the results which have been brought about by the author in reducing the bacterial counts in the milk at three milk plants through laboratory supervision. A previous paper based on this work was noted (E. S. R., 47, p. 280).

Production and care of cream for shipment, M. R. TOLSTRUP and C. G. CUSHMAN (*Clemson Agr. Col. S. C., Ext. Circ. 35* (1922), pp. 8, figs. 5).—Suggestions are given of the main points to be considered in producing good cream, i. e., clean barns, clean milking practices, clean utensils, not feeding silage, turnips, wild onions, etc., just before milking, immediate separation of milk after milking, proper cooling of cream, and proper care in shipping cream.

Yeast and mold counts and their relation to pasteurization of cream for butter making purposes, B. A. STIRITZ (*Jour. Dairy Sci.*, 5 (1922), No. 4, pp. 362-371).—After presenting data collected at the Illinois Experiment Station showing the yeast and mold counts of raw cream, pasteurized cream, ripened cream, butter, buttermilk, and starter, the author concludes that since the cream may be contaminated by the starter or more frequently by the churn, the yeast and mold counts of finished butter can not be taken as an efficiency index of pasteurization, nor as a method of determining whether butter has been made from raw or pasteurized cream. The yeast and mold counts of butter may, however, be taken as an efficiency index of the entire butter making process.

The determination of yeasts and Oidia in cream and butter, H. W. REDFIELD (*Jour. Dairy Sci.*, 5 (1922), No. 1, pp. 14-21).—A table is presented in which 88 samples of butter are arranged according to the score of the butter, with data furnished showing the microscopical and cultural counts of yeast and Oidia found in the butter, and microscopical counts of these organisms found in the cream previous to churning as far as available. The low grade samples of butter and cream in general show high counts for yeast and Oidia, but it is evident that there are other factors which have caused the deterioration of the butter.

Microorganisms in creamery butter, T. H. LUND (*Sci. Agr.*, 2 (1922), No. 10, pp. 332-340, fig. 1).—Continuing the work previously noted (E. S. R., 44, p. 874), the Oidium and yeast counts are reported on butter made from pasteurized cream at a number of Canadian creameries. The results showed that pasteurizing was an effective method of reducing the Oidium counts, but the yeast counts in butter made from pasteurized cream were often very high. As in the previous work, it is concluded that this is mainly due to contamination in the churn and not to the fact that pasteurizing does not kill the yeast. Methods are suggested for sterilizing the churn with lime water and steam.

Principles and practice of butter making, G. L. MCKAY and C. LARSEN (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd.*, 1922, 3. ed., rev., pp. XIV+405, figs. 133).—In preparing the third edition of this book, the second edition (E. S. R., 21, p. 177) has been largely rewritten, and new chapters dealing with milk and its products for food, neutralization of cream, defects in butter, and storage of butter have been added.

Defects in the quality of butter, C. W. FRYHOFFER (*U. S. Dept. Agr., Dept. Circ. 236* (1922), pp. 14).—The author has briefly summarized the methods in scoring butter and explained why the cuts in the score are made. The various defects in the quality of butter are discussed, and the methods of preventing each defect are given in detail.

Review of the bacteriological aspects of cheese ripening, G. J. HUCKER (*New York State Sta. Tech. Bul. 89* (1922), pp. 3-36; also in *Abstr. Bact.*, 5 (1921), No. 8, pp. 287-303).—This is a review of the history of the bacteriological studies of cheese ripening containing a chronologically arranged bibliography of 242 references dating from 1872 to 1921, inclusive.

The types of bacteria found in commercial Cheddar cheese, G. J. HUCKER (*New York State Sta. Tech. Bul. 90* (1922), pp. 8-38).—This is a complete report of the investigations previously noted from an abstract (E. S. R., 47, p. 583.)

A study of the chemical and physical properties of remade milk, L. S. PALMER and C. D. DAHLE (*Jour. Dairy Sci.*, 5 (1922), No. 1, pp. 1-13, fig. 1).—The results of an investigation of the physical and chemical properties of remade milk are reported from the Minnesota Experiment Station in which the comparative freezing point, specific gravity, viscosity, specific conductivity, creaming ability, appearance on standing, solubility of proteins, rennet coagulability, H-ion concentration, and enzym activity were determined for normal or pasteurized milk and for milk remade from milk powdered by the drum or Just-Hatmaker process, pressure spray or Merrill-Soule process, and the centrifugal spray, and from milk remade from skim milk powder, water, and unsalted butter.

The results indicated that remade milks were very similar to normal and pasteurized milk in most of these characteristics, though there was some variation caused by the different methods of manufacture. The drum process milk was lacking in peroxidase, failed to coagulate with rennet, was deficient in soluble proteins, possessed abnormal electrical conductivity, and was more viscid than normal milk. Some of these abnormal characteristics were also exhibited by the other milks, but the least differences were shown by the milk remade from milk dried by the centrifugal spray.

VETERINARY MEDICINE.

[Live stock disease investigations] (*North Dakota Sta. Bul.* 159 (1922), pp. 42-44).—In dialyzing experiments with swamp fever virus in which three methods were used, it was found that the virus was dialyzable regardless of the membranes and media used, indicating it to be of a crystalloid nature. In studies during the year a field virus was encountered which produced fever and other characteristic symptoms of the disease within 72 and 96 hours, respectively, in two susceptible horses. The virus was extremely virulent and caused the death of the animals in a comparatively short time. In an attempted production of the disease in swine with a view to using them for diagnosing swamp fever in horses, two pigs injected intramuscularly with 10 cc. each of virulent serum from a field case failed to produce symptoms. Blood from the two pigs was introduced into two other experimental pigs and a normal horse without producing the disease.

In work with gastrophilus bots, colts given the ophthalmic test at birth with gastrophilus extract were all found refractory, but when subjected to the same test 11 to 14 days later all gave positive reactions, indicating that they obtained a sensitization through the mother's milk.

Common diseases of horses, cattle, and swine, R. L. TUCKER ([*Hamilton*], *Bermuda Dept. Agr.*, 1922, pp. 54).—This is a popular summary of information.

Affections of the skin of live stock, A. RIVERA (*Porto Rico Dept. Agr. and Labor Sta. Circ.* 68 (1922), *Spanish ed.*, pp. 3-9).—This is a brief popular account of the affections of the skin of live stock met with in Porto Rico.

Communicable diseases of animals.—Glanders (*War Dept. [U. S.], Army Regulat.* No. 40-2100 (1921), pp. 7).—This and the two following circulars contain information for the use of Army veterinary officers in the control of glanders. A brief discussion is given in this circular of the nature and importance of glanders, methods of control, and clinical signs. This is followed by a general description of the ophthalmic and intradermic mallein tests and retests and of the serological tests, a discussion of the conditions under which the mallein test is required and of the responsibility for mallein testing, and directions for glanders autopsies.

The ophthalmic mallein test of animals (*War Dept. [U. S.], Army Regulat. No. 40-2105 (1921), pp. 3.*)—Detailed directions are given for the application and interpretation of the ophthalmic mallein test.

The intradermic mallein test of animals (*War Dept. [U. S.], Army Regulat. No. 40-2110 (1921), pp. 3.*)—Similar directions for the intradermic mallein test.

Studies of immunity against hemorrhagic septicemia, L. VAN ES and H. M. MARTIN (*Nebraska Sta. Research Bul. 21 (1922), pp. 3-38, figs. 2.*)—To test the immunizing value against infection with cattle and swine strains of *Bacillus bipolaris septicus* of sera purchased from dealers in biological products, rabbits were injected subcutaneously with the serum in question, and later intravenously with virus in the form of a 24-hour bouillon culture of the corresponding strain of *B. bipolaris septicus*. Two series of experiments were conducted with each serum. In one the dosage of serum varied and the virus was injected 24 hours later. In the other the animals all received a fixed amount of serum, and the virus was given at varying intervals of time. Second injections of virus were given to all surviving animals, usually two weeks after the first virus injection.

The results obtained were in general alike for the serums of both the cattle and the swine strains. While there were differences in the potency of the different serums examined, a marked protective influence was shown in that in some cases the death of the experimental animals following the virus injection was prevented, and in others the survival period was increased over that of those treated with normal serum and those serving as virus controls. Of the 69 rabbits treated with serum in the first group, 26 survived the first injection of virus, but none of these survived a second injection two weeks later, although the survival periods were somewhat lengthened. The variation in the dosage of serum administered did not have a marked effect on the transient immunity induced, though there were marked differences in the potency of the serums examined. In the corresponding tests of swine strain serums, 25 out of 48 animals survived the first injection of virus and 2 of the 25 survived the second injection.

In the experiments in which a uniform dose of serum was given, followed by the virus at different intervals of time, the influence of the serum was shown in the survival periods of the treated animals. In general, as the intervals between serum and virus inoculations lengthened, there was a corresponding decrease in the survival period. After 6 or 7 days the protective power of the serum had entirely disappeared.

"The fact that certain sera are in a measure protective against infection by *B. bipolaris septicus* warrants the hope that it may be possible so to improve them as to cause them to be of practical value. Further study and investigation with that object in view are both needed and justifiable."

Experimental epidemiology.—Introductory, S. FLEXNER (*Jour. Expt. Med., 36 (1922), No. 1, pp. 9-14.*)—This paper is introductory to the six which follow dealing with various aspects of experimental epidemiology as observed in natural and artificially induced epidemics of gastrointestinal infection in mice, the so-called mouse typhoid. In discussing briefly the history of epidemic diseases in man, attention is called to the fact that within a century the prevalent type of epidemic disease has changed from diseases of enteric to those of respiratory origin. This is explained on the ground that for diseases of the former type, such as typhoid and allied fevers, malaria, typhus, and yellow fever, communal or general methods for prevention have been developed, while the epidemic diseases which prevail almost unchecked are those for

which no communal means exist for preventing the carrying of infection from individual to individual.

An outbreak of mouse typhoid and its attempted control by vaccination. C. J. LYNCH (*Jour. Expt. Med.*, 36 (1922), No. 1, pp. 15-23, pl. 1).—This paper describes briefly an epidemic of so-called mouse typhoid which prevailed to a greater or less extent for about 2½ years in a mouse breeding station maintained at the Rockefeller Institute for Medical Research. During this period there were two major outbreaks, one reaching its peak on November 9, 1918, and the other on November 13, 1920. The entire duration of the 1918 outbreak was about 140 days and of the 1920 125 days. Between these two outbreaks about half of the entire colony was vaccinated subcutaneously with a single injection of 0.2 cc. of a suspension (or about 600,000) of killed bacilli of the strain of mouse typhoid designated Mouse Typhoid I, isolated during the epidemic. The immunological study of the cultures of the mouse typhoid bacilli isolated from the second outbreak showed that they belonged to a different strain from the one responsible for the first outbreak. This is thought to be of particular significance in indicating that the vaccination of part of the surviving population after the first epidemic was sufficient to protect the entire population from infection with the first variety, but to leave the entire population subject to the second variety of mouse typhoid bacillus.

While no extensive study was made of carriers, the examination of 10 mice which had passed through both epidemics and 10 of their offspring gave negative results as to the presence of both strains of the organism, with the exception of one mouse from which Mouse Typhoid I was recovered from the cecum only.

Experimental epidemiology.—I, An artificially induced epidemic of mouse typhoid. II, Effect of the addition of healthy mice to a population suffering from mouse typhoid, H. L. AMOSS (*Jour. Expt. Med.*, 36 (1922), No. 1, pp. 25-69, figs. 7).—The first of these two papers presents the general features of the experimental production of an epidemic of mouse typhoid similar to the natural epidemic reported by Lynch, and the second discusses in considerable detail the most important phase in the production of this epidemic, i. e., the effect of bringing a healthy stock of mice into a community in which mouse typhoid is prevailing. The scope and results of the work may be summarized as follows:

The mice were kept in cages of 5 each in a room in which the cages could be placed close together or separated by a distance of about 12 ft. The original infection was induced by the introduction into one group of 100 mice of two cages containing 10 mice which had been fed on a culture of mouse typhoid bacilli. The spread of the infection was left to accident through the attendant who fed the animals and cleaned the cages. From time to time the animals which had succumbed were replaced with fresh stock.

The first effect of the exposure of the mice to a small number of mice fed on the culture was the occurrence of a sporadic but not an epidemic outbreak of mouse typhoid. The introduction of fresh normal mice into the community led regularly to an epidemic spread of the disease beginning with deaths among the new mice, but invariably extending to the old mice and ending before all the mice had succumbed. Each new addition of normal mice resulted in another epidemic wave.

Evidence was also secured that the degree of infectivity of the mouse typhoid bacilli was highly fluctuating, and that this accounts to some extent for the wavelike movement of the epidemic disease. "This quality of infectivity, or virulence, is one factor in the process but alone does not suffice to account for the observed facts. A second influence is not improbably quantity,

or dosage, of the inciting microorganism." In highly susceptible animals the multiplication of the organism becomes very rapid, so that there is a wider spread of much larger amounts of the organism.

Experiments on normal and immune mice with a bacillus of mouse typhoid, L. T. WEBSTER (*Jour. Expt. Med.*, 36 (1922), No. 1, pp. 71-96, figs. 6).—This paper reports the results of a series of experiments undertaken to determine the varieties and degrees of resistance in normal and immunized mice to the mouse typhoid strain obtained in the experimental epizootic studies of Amoss noted above.

Following intrapleural or intraperitoneal injection of normal mice with live creatures of this organism, there was an initial lag in the rate of bacterial multiplication which lasted for a few hours and was followed by a rapid multiplication of the organism until death occurred, usually within eight days. Inoculation of normal mice per os resulted in an incubation period of about 5 days, after which the animals in general developed symptoms of the disease and died. A small percentage, however, proved refractory to infection by this route.

When mice were injected intrapleurally or intraperitoneally with dead bacilli, the subsequent inoculation of live cultures caused death only after a greater interval of time or not at all, the results depending upon the degree of protection afforded by the vaccination. This partial protection was entirely of a general nature, no evidence of a local immunity alone being obtained.

Identification of a paratyphoid enteritidis strain associated with epizootics of mouse typhoid, L. T. WEBSTER (*Jour. Expt. Med.*, 36 (1922), No. 1, pp. 97-105).—Serological studies of the strain of mouse typhoid bacillus known as Strain Mouse Typhoid II of the previous studies are reported. These studies identify the bacillus as *Bacillus pestis caviar*, which produces similar affections in guinea pigs and is closely related to the type "mutton" *aertrycke* strain of Schütze.

Immunological distinctions of two strains of the mouse typhoid group isolated during two spontaneous outbreaks among the same stock, H. L. AMOSS and P. P. HASELBAUER (*Jour. Expt. Med.*, 36 (1922), No. 1, pp. 107-113).—In this paper evidence is presented that the Mouse Typhoid II strain, *Bacillus pestis caviar*, is antigenically different from the Mouse Typhoid I strain isolated from the first outbreak of mouse typhoid reported by Lynch. Mouse Typhoid I is considered to be related to but not identical with two strains of enteritidis, and Mouse Typhoid II to be related to but not identical with the human paratyphoid B strains.

Some recent additions to the knowledge of ascariasis, B. H. RANSOM (*Jour. Amer. Med. Assoc.*, 79 (1922), No. 14, pp. 1094-1097, fig. 1).—A summary of the present status of knowledge of *Ascaris lumbricoides* based upon investigations, a recent account of which has been noted (*E. S. R.*, 47, p. 182). The paper includes a diagrammatic scheme of the circulation, in which arrows indicate the direction of the blood and lymph flow, and the paths of migration of *Ascaris* larvae, including both theoretically possible and proved paths.

Observations on the life history of *Ascaris vitulorum*, a parasite of bovines in the Philippine Islands, B. SCHWARTZ (*Philippine Jour. Sci.*, 20 (1922), No. 6, pp. 663-668, pl. 1).—Studies here reported have been summarized as follows:

"Eggs of *A. vitulorum* were observed to develop rapidly under the influence of tropical conditions, and many contained embryos in about 10 to 12 days. Ingestion of embryonated eggs by experimental animals resulted in the hatching of the embryos in the intestine and in the elimination of undeveloped eggs and of dead embryonated eggs with the dejecta from the alimentary canal.

Hatching is apparently the result of the activities of the larvae under the stimulus of body temperature and probably also of the general intestinal environment. The eggs of *A. vitolorum* can withstand drying if they are protected from the direct rays of the sun. Dry and moist eggs are rapidly destroyed by tropical sunlight, the destructive action being independent of the light rays. The temperature under which these experiments were carried out was 45° C.

"The larvae of *A. vitolorum* were found to linger in the liver of guinea pigs for longer periods than the larvae of *A. lumbricoides*, and were still present in the liver after the lungs had become free from parasites. This appears to indicate an arrest of larvae in that organ. In heavy experimental infections other organs besides the lungs and liver, notably the kidneys, were heavily invaded by larvae. Guinea pigs appear to be more resistant to the effects of the invasion of the lungs by larvae of *A. vitolorum* than they are to the effects of a similar invasion by larvae of *A. lumbricoides*."

Carbon tetrachlorid as an anthelmintic, M. C. HALL (*Amer. Jour. Trop. Med.*, 2 (1922), No. 5, pp. 373-379).—In this paper, which was read before the eighteenth annual meeting of the American Society of Tropical Medicine on May 3, 1922, the many advantages possessed by carbon tetrachlorid as an anthelmintic are pointed out. The pure drug introduced into the digestive tract appears to be astonishingly safe as far as tried with a number of experimental animals. The author and Shillinger have found that dogs will tolerate doses of 16 cc. and chickens 20 cc. per kilogram, even when the animal receiving these doses has been given comparatively large doses of the drug a few days previously. Experiments indicate that it loses some of its anthelmintic efficacy when administered in castor oil or when given in capsules and immediately followed by castor oil. The paper is based upon investigations by the author, a previous account of which has been noted (*E. S. R.*, 46, p. 686).

Bovine staggers or pushing disease in Natal, R. SCHARER (*Jour. Compar. Path. and Ther.*, 35 (1922), No. 2, pp. 125-132, fig. 1).—This account deals with the isolation of the glucosid of the toxic plant *Matricaria nigellaefolia*, which glucosid is the cause of the disease in cattle in South Africa, and its treatment.

The lesions in lungworm disease ("husk" or "hoose") of cattle, R. DAUBNEY (*Jour. Compar. Path. and Ther.*, 35 (1922), No. 2, pp. 108-117, figs. 6).—"The adults of *Dictyocaulus viviparus* inhabit chiefly the medium sized and smaller bronchi, where they produce bronchitis and peribronchitis with a fibroblastic reaction involving the peribronchial alveoli. The worm brood of *D. viviparus* produces bronchitis and peribronchitis similar to the above in the smaller bronchioles. When aspirated into the alveoli the worm brood produces a localized pneumonia, which may be catarrhal or interstitial in character according to whether the condition is acute or chronic.

"Considerable areas of lung may in this manner be rendered functionless without the aid of secondary invading bacteria. The extent of the pneumonic changes would appear to depend largely on the severity of the infestation, the age, and condition of the affected animal. Extensive atelectasis may occur as the result of plugging of the medium sized and smaller bronchi by the exudate and the bodies of the adult worms, while a similar condition may be produced in small areas as a result of the plugging of the smallest bronchioles with exudate and worm brood. Vesicular emphysema may occur. This may either be compensatory or largely due to the mechanical distension produced in coughing."

The thyroid gland of the "bulldog" calf of the Dexter, F. A. E. CREW and E. J. G. GLASS (*Jour. Compar. Path. and Ther.*, 35 (1922), No. 2, pp. 117-121, figs. 3).—"The thyroid gland of bulldog calves is not normal in histological

structure. The abnormality is not that which is associated with the general condition of cretinism, for the gland shows hyper- rather than hypofunctioning."

The significance of colostrum to the newborn calf. T. SMITH and R. B. LITTLE (*Jour. Expt. Med.*, 36 (1922), No. 2, pp. 181-198).—To study the effect of withholding colostrum from young calves, one group of 12 calves from a large herd was removed from their mothers directly after birth and fed fresh raw milk, while another group of 10 was suckled. Of the 12 receiving no colostrum, 9 died in from 3 to 11 days, 1 became lame, and the other 2 were normal. Of the 10 receiving colostrum, all survived the danger period, but 3 died after 25, 38, and 45 days. From the organs of the animals not receiving colostrum, *Bacillus coli* was isolated in every case. The cause of the death of the 3 animals in the other group has not been determined, but in 2, from whose organs cultures were made, bacteria could not be demonstrated.

The authors conclude "that the function of the colostrum is essentially protective against miscellaneous bacteria which are harmless later on when the protective functions of the calf have begun to operate and accumulate energy. There appears to be no function inherent in colostrum which controls development or growth or which is essential to the starting of the mechanism of digestion, since calves not having had colostrum appear to do as well as the others when the infection has been overcome."

Experimental investigations of an eruptive disease of the goat observed in Greece. G. BLANC, C. MÉLANIDI, and J. CAMINOPETROS (*Ann. Inst. Pasteur*, 36 (1922), No. 8, pp. 614-618).—This is a report of studies of an eruptive disease of the goat frequently met with and well known by peasants in Greece, who attribute it to the ingestion of certain plants. This disease, which the authors have transmitted experimentally, is in reality caused by a virus, some of the characteristics of which have been determined and show it to belong to the pox group.

Hog cholera (*North Dakota Sta. Bul.* 159 (1922), pp. 40-42).—In continuation of the hog cholera studies previously noted (E. S. R., 45, p. 285), it is reported that the disease has been induced by a dilution of virus equivalent to 0.00002 cc. of the original virus. This is thought to furnish sufficient proof that the virus "is not a protein or other possible toxin, but a living infectious organism which propagates and reproduces itself within the animal body and causes the disease." Dialyzing membranes, including parchment, gold beater's skin, and collodion membranes have been found to be impermeable to the virus of hog cholera when water, salt solution, or Ringer's solution was used as the dialyzing medium, and permeable when hog-cholera serum or normal horse serum was used. The possibility is suggested that in the latter case the virus penetrates the dialyzing membrane by a process of growth.

No attenuation of the virus could be noted following oxygenation for a period of 45 hours, acidulation with 1 per cent of acetic acid or dilution with 9 times its volume of distilled water for 72 hours, precipitation of the serum globulins from the virus by the action of carbon dioxide for 72 hours, or half saturation or complete saturation of the virus with ammonium sulphate.

A contribution to the history of the house fly as an agent in the transmission of equine habronemiasis: The life cycle and parasitism of *Habronema megastoma* (Rud. 1819) in the house fly. E. ROUBAUD and J. DESCAZEUX (*Bul. Soc. Path. Exot.*, 14 (1921), No. 8, pp. 471-506, pl. 1, figs. 9).—This is a summary of recent work on the development of *H. megastoma* and its transmission, including experimental work by the authors. A bibliography of 25 titles is included.

Canine distemper: Its complications, sequelae, and treatment. H. KIRK (*London: Baillière, Tindall & Cox*, 1922, pp. XII+226, figs. 29).—The several

chapters of this monograph deal with the subject, respectively, as follows: Historical; susceptibility; etiology; bacteriological notes; predisposing causes; sources of infection and their practical avoidance; preventive inoculation; symptoms; course, prognosis, and mortality; morbid anatomy; differential diagnosis; and treatment and convalescence.

Roup in fowls, A. J. DURANT (*Missouri Sta. Bul.* 196 (1922), pp. 12, figs. 2).—This summary of information on the subject includes an appended review of the literature relating to experimental work with it (pp. 8-12).

Observations on the development of *Heterakis papillosa* Bloch in the chicken, C. URIBE (*Jour. Parasitol.*, 8 (1922), No. 4, pp. 167-176, pls. 3, fig. 1).—This paper deals with the anatomy, development, and biology of *H. papillosa* and with the pathological changes with which it is associated.

The author's studies of the resistance of this species to heat and drying confirm the results obtained by Graybill (*E. S. R.*, 46, p. 281). The eggs were found to develop uninjured in 1.5 per cent nitric acid, a strength that renders the material external to the egg bacteriologically sterile, which may be of value in determining the source of the protozoan of blackhead.

After hatching in the intestine of the fowl, *H. papillosa* undergoes its further development in the ceca, and in no instance were larval worms found in other organs or in other portions of the body. Throughout the first stages of their development and for the first five days most of the larvae are to be found buried in the glands of the cecal mucosa.

"As they increase in size, many show the anterior extremity inserted in the mucosa, but the mature worms usually are free in the lumen of the cecum. It is apparent from the measurement of a considerable number of worms that the rate of growth is accelerated after each molt. Since females containing eggs were not found until after eight weeks from the time that the eggs were fed, a considerable period of time is apparently required for this species to mature. Not only are the eggs passed in the cecal discharge, but occasionally dead females are also found. After sufficient incubation for the eggs to ripen, such material should produce heavy infestation on ingestion by a suitable host.

"Although the adult stage of *H. papillosa* lives in the lumen of the cecum, it is not rare to find these worms with the head buried in the mucosa, and probably in rare instances the entire worm may be buried in the cavity of the lymph nodules which occur at intervals in the wall of the cecum. It is probable that the adult worms usually feed upon the cecal contents, but all those derived from a certain case showed blood in the alimentary tract. This may have been the result of unusual circumstances, for the hen from which they were derived had eaten nothing for several days prior to its death and showed a peritonitis at post-mortem. The structure of the mouth and the possession of definite teeth suggest the possibility of attachment and the utilization of tissue fluids as food. No evidence has been obtained that this parasite produces very serious injury to the cecal mucosa of the chicken."

RURAL ENGINEERING.

The farmer's short-box measuring flume, C. ROHWER (*U. S. Dept. Agr. Bul.* 1110 (1922), pp. 13, figs. 8).—Studies on a short-box measuring flume conducted under a cooperative agreement between this Department and the Colorado Experiment Station are presented in this report. Tables and charts are presented which are applicable to a standard short-box measuring flume, which includes a weir with completely suppressed end contractions and a partially suppressed bottom contraction. No provision is made for the aeration and lateral expansion of the nappe, as required in the standard weir without end contractions. The floor of the weir box is level and is placed at the grade

of the ditch in which it is installed. The weir bulkhead is variable in height, depending on the conditions it has to fulfill, and it is usually made from the commercial sizes of 2-in. lumber. No attempt is made to keep a sharp edge at the crest. The bulkhead is not fixed, but may be removed by sliding it out of grooves in the walls of the weir box for the purpose of cleaning.

The following formulas for free and submerged flow for this measuring flume were deduced from the data obtained:

Free flow:

$$Q = \frac{3.566}{(P - 0.300)^{0.0164}} L H^{1.525} \quad (I)$$

Where Q = discharge in cubic feet per second.

P = height of the weir in feet.

L = width of the flume in feet.

H = head in feet, measured at the upper gauge point.

Submerged flow:

$$Q = 4.12 \frac{H_a^{0.418} (P - 0.300)^{0.080}}{P^{0.170}} \frac{1.37 H_d^{0.091}}{P^{0.139}} L H_a \quad (II)$$

Where H_a = head in feet measured at the upper gauge point.

H_d = difference of head in feet between the upper and the lower head

These are empirical formulas based on the calibration of 1, 2, 3, and 4-ft. flumes with 4, 8, 12, and 16-in. weirs for various heads and differences of head.

A comparison of the experimental discharges with the computed discharges for the free flow and for the submerged conditions showed that 77 per cent of all the free-flow-computed discharges were in error by less than 2 per cent, and that 74 per cent of all the submerged-flow-computed discharges were in error by less than 5 per cent. The results showed that the submerged condition should be avoided if possible. For free flow conditions it was found that the gauge height may be measured either on the crest of the weir or 1 ft. upstream from it. For submerged conditions, both the upstream and the downstream heads must be measured. Changes such as might occur in the flumes in the field do not affect the discharge sufficiently to impair the usefulness of the device. Its accuracy is considered to be sufficient for ordinary requirements, but it is not recommended in preference to the standard types of weirs.

Experiments on capacities of soils for irrigation water, O. W. ISRAELSEN and F. L. WEST (*Utah Acad. Sci. Trans.*, 2 (1918-1921), pp. 139-141).—This is an abstract of a report of experiments conducted at the Utah Experiment Station.

The observations show that an appreciable downward movement of water continued in each of three plats from June 14, the date of irrigation, to October 11, the date of the last sampling. The water was applied through small ditches in heads varying from 0.1 to 0.2 cu. ft. per second. As soon as the water disappeared from the surface of the plats an 8-in. straw mulch was applied to reduce evaporation.

The data show that a 12-in. application of water did not reach the 12-ft. depth of soil for several days, but that some of a 24-in. application passed through the upper 12 ft. the third day after irrigation and that much of a 36-in. application had gone below the 12-ft. point one day after the water was applied. There was a gradual loss of water from the upper 6 ft. of soil as the season advanced. The quantities of water found were not appreciably influenced by the depth of soil selected as the index of capacity. The rate of downward movement of water decreased rapidly after the fifth day after irrigation.

The maximum ratio of the moisture equivalent to the moisture content increased in the soil to which 12 in. of water was applied from 1.09 on June 20 to

1.17 on June 26, and the minimum increased from 0.86 to 0.92, considering only the upper 6 ft. of soil. The average ratio ranged from 0.98 to 1.05. The average maximum and minimum for the individual foot sections on the plats receiving 24 and 36 in. of water were almost exactly the same as for the plat receiving 12 in.

Earth fill dams and utilization of streams, A. TROUILLET (*Dir. Gén. Agr., Com. et Colon. [Tunis], Bul. 26 (1922), No. 108, pp. 31-46, figs. 6*).—The construction of earth fill dams as a part of structures for the utilization of stream water for irrigation in Tunis is described and illustrated.

Revenue report on the irrigation works of the Ajmer-Merwara District for the year ending March 31, 1921, S. B. PATTERSON ET AL. (*Ajmer-Merwara Irrig. Works Rev. Rpt., 1921, pp. 23, pls. 2*).—This report includes data on irrigation work in the Ajmer-Merwara District of the Rajputana Province of India for the year ended March 31, 1921.

Conservation of the waters of the Colorado River from the standpoint of the Reclamation Service, F. E. WEYMOUTH (*Science, 56 (1922), No. 1438, pp. 59-66*).—This report embodies the recommendations of the U. S. Reclamation Service for the conservation of the waters of the Colorado River for use in irrigation.

Surface water supply of Snake River Basin, 1917 (*U. S. Geol. Survey, Water-Supply Paper 463 (1922), pp. V+168, pls. 2*).—This report, prepared in cooperation with the States of Idaho, Oregon, Nevada, and Washington, presents the results of measurements of flow made on streams in the Snake River Basin and tributary basins during the year ended September 30, 1917.

Factors governing the selection and protection of sources of water supply, J. K. HOSKINS (*Public Health Rpts. [U. S.], Sup. 39 (1921), pp. 20*).—Practical information on the subject is presented in this publication. It is stated that determinations of the nature and extent of use of a proposed water supply will indicate the inadvisability of selecting certain inadequate or unsuitable sources. Such determinations will also make evident the necessity for accurate knowledge concerning the quantity and quality of water to be expected from various sources. The possibility of pollution of the source is a factor to be carefully considered, as well as the natural safeguards that exist or can be inaugurated that tend to counteract such pollution. Finally, the relative cost of supplies developed from various sources, carefully balanced against their advantages, will largely determine the source to be chosen. This factor may outweigh many other considerations and indicate the advisability of artificial purification rather than the selection of an uncontaminated source.

Columns, E. H. SALMON (*London: Henry Frowde and Hodder & Stoughton, 1921, pp. XVI+279, figs. 79*).—This treatise on the strength and design of compression members is one of the Oxford Technical Publications. Part 1 consists of an extensive bibliography. Part 2 consists of analytical matter, and includes chapters on general formulas for solid columns, lattice-braced columns, and columns with lateral loads. Part 3 consists of synthetical matter, and contains chapters covering the more practical features of column design and a summary of both theory and experiment which have been established on the subject.

Experiments with [internal-combustion engine fuel] G. KÜHNZ (*Tech. Landw., 3 (1922), No. 8, pp. 189, 190, fig. 1*).—Comparative studies of so-called "reichskraftstoff," an internal-combustion engine fuel consisting of 53 per cent of benzol, 34 per cent of alcohol, and 13 per cent of tetralin, with plain benzol are reported.

It was found that the composition fuel had almost as high a thermal efficiency as the pure benzol. No great difficulties were experienced in starting with the

composition fuel except when the engines were very cold. Higher compression ratios could be used than with pure benzol.

The use of alcohol as a fuel for motor cars using internal-combustion engines, J. G. ROSE (*So. African Jour. Indus.*, 5 (1922), No. 7, pp. 307-312).—This is a discussion of the use of alcohol as a fuel for internal-combustion engines, with particular reference to South African conditions. Special attention is paid to the economic phase of the subject occasioned by the necessity for denaturing. It is stated that the heavy cost of denaturants is not warranted by the results they achieve, and that frequently such denaturants as methyl alcohol have a very bad effect upon motors, especially if they are impure. It is concluded that the policy of collecting revenue from the sale of alcoholic liquors by means of an excise, with the resultant use of denaturants, constitutes a real impediment to the production of a cheap motor fuel.

Power losses in automobile tires, W. L. HOLT and P. L. WORMELEY (*U. S. Dept. Com., Bur. Standards Technol. Paper* 213 (1922), pp. 451-461, pl. 1, figs. 7).—Studies on the power loss or energy dissipated as heat in automobile tires when operated under different conditions of axle load, inflation pressure, speed, and tractive effort are reported.

The loss was found to increase directly with an increase in speed or axle load, and quite rapidly with a decrease in air pressure below the standard. Tractive effort had a comparatively small effect upon the power loss. There was a wide variation in the power loss in different tires run under the same conditions. Some makes of tires showed a larger power loss than others, and fabric tires as a class showed a considerably greater loss than cord tires.

Tractors on southern farms, H. R. TOLLEY and L. M. CHURCH (*U. S. Dept. Agr., Farmers' Bul.* 1278 (1922), pp. 26, figs. 3).—This bulletin summarizes the experience of 684 tractor owners in the States of Alabama, Georgia, North and South Carolina, and Tennessee, obtained as the result of a letter questionnaire sent to each of several thousand men in these States who were known to own tractors. Data are given on the estimates of the users as to advantages and disadvantages, profitable use, best size, life and depreciation, and cost of operation, maintenance, and repair of tractors.

Tractor and plow reactions to various hitches, O. B. ZIMMERMAN and T. G. SEWALL (*Jour. Soc. Automotive Engin.*, 11 (1922), No. 1, pp. 107-115, figs. 17).—Some of the questions involved in the subject are enumerated, and analyzed in part by the aid of diagrams and applied mathematics. Comparative draft data are presented in tabular form and discussed, as well as comparative hitch-length data. Tractor reactions are explained in a similar manner, attention being given to the reactions on a slope and uphill. The factors involving tractor stability and resistance against overturn are also analyzed. These analyses are presented as a definite method of attack for the more correct solution of the proper hitching point and a study of lug design.

Dust explosions, D. J. PRICE and H. H. BROWN (*Boston: Natl. Fire Protect. Assoc.*, [1922], pp. XXI+246, figs. 85).—This book is based upon the work of the U. S. Department of Agriculture on the subject and gives the results of investigations, made by the Department through a period of several years, into the theory, nature, and causes of dust explosions of different kinds, and methods for their prevention. It is stated that all industrial plants in which a dust is produced in the handling of carbonaceous material or in the manufacture of various products from this material are subject to the possibility of an explosion.

The subject is approached by a consideration of what a dust explosion really is and of the different factors which affect its nature or behavior. The results of studies of what explosions have done and of the facts indicated by those

which have occurred in the various industries are next presented, and measures are discussed which have proved most effective in preventing an explosion or in retarding its development when once started.

The book includes other chapters on industries producing dust and their extent, causes of dust explosions and elimination of sources of ignition, prevention of explosions by control of explosive mixtures, phenomena of explosions, dust collection and removal, static electricity, explosions in grain thrashing machines, plant construction, cotton-gin fires, coal-dust explosions, and a review of explosions.

Some notes on railway refrigerator cars, W. H. WINTERBOWD (*Mechan. Engin.* [New York], 44 (1922), No. 7, pp. 419-426, figs. 14).—This is a collection of what are considered to be the more important facts regarding the principles and methods involved in railway refrigerator car operation, and the types of cars and methods of construction used by various railways and private-car owners.

The conclusion is drawn that while a very great improvement has been made in refrigerator-car construction and design within the past few years, the field of investigation in connection with cars of this type is still a most fertile one. The construction of some fairly recent cars indicates that the subject of refrigeration in transit is not appreciated in some quarters as it should be. Efficiency in refrigeration is also considered to be quite important.

The principles of mechanical refrigeration, H. J. MACINTIRE (*New York and London: McGraw-Hill Book Co., Inc.*, 1922, pp. VIII+252, figs. 114).—This book is intended as a study course for operating engineers and covers the entire field of refrigeration in an elementary manner. It contains chapters on the compressor; condensers, ammonia piping, and accessories; other refrigerating systems; erection and operation; refrigerants, heat transfer; piping and piping calculations; ice making; and applications of refrigeration.

Modern plumbing illustrated, R. M. STARBUCK (*New York: Norman W. Henley Pub. Co.*, 1922, 4. ed., rev. and enl., pp. 407, figs. 68).—This is the fourth revised and enlarged edition of this book (E. S. R., 35, p. 690).

RURAL ECONOMICS AND SOCIOLOGY.

First report on the Turretfield Demonstration Farm, A. J. PERKINS (*Jour. Dept. Agr. So. Aust.*, 26 (1922), No. 2, pp. 119-143).—This farm, situated 10 miles from Gawler, South Australia, consists of 1,604 acres, of which 1,251 are urable, 334 comprise the grazing area, and 19 are occupied by buildings, yards, etc. It has been conducted for nine months in an effort to demonstrate financially the principles on which farming should be carried on in that particular district.

The present report covers the period ended March 31, 1922. The farm is being run on a three-course rotation, including bare fallow, wheat or hay, and barley or oats, with sheep and pigs as cash-earning live stock. Separate accounts are presented showing the expenditures and receipts from wheat, hay, barley, pigs, oats, sheep, produce and other supplies in the inventory, poultry, cattle, working horses, etc. From the point of view of capital invested by the Government, the net return after all deductions were made amounted to interest at the rate of 7.73 per cent per annum. The net earnings of the manager, taken as the owner, after making due allowance for interest under every head, were £5 19s. 5d. in the nine months over and above the family living. Most of the crops gave a satisfactory yield and a net profit. The cost of keeping horses was 2s. 4d. per day. Bare fallow cost 12s. 1d. an acre to March 31.

Comparison of the costs of plowing with tractors, horses, and cattle, M. LAPLAUD (*Rev. Zootech.* [Paris], 1921, Nos. 2, pp. 141-151; 3, pp. 227-240,

figs. 2).—Experiments are reported dealing with the amount and cost of plowing done by horses, tractors, and cattle at the Vaulx-de-Cernay Station for 1919-21. In making these comparisons daily notes were taken on the amount and kind of soil in which the work was done and the expenses which were incurred in feeding, repairs, etc. All the plowing was 0.15 meter (6 in.) deep and 0.33 meter (13 in.) wide. The plows consisted of a two bottom Oliver used with Fordson tractors, and Brabant and Benceronne plows used with the horses and cattle. The costs and comparisons are given in detail in tables presented based on fixed and variable costs for each source of power. In the case of the tractors the fixed costs consisted mainly of upkeep, interest, depreciation, insurance, etc., whereas the variable costs consisted of fuel and man labor. In the cases of the horses and cattle the fixed costs consisted of shoeing, harness, veterinarians' fee, interest, depreciation, and insurance, whereas the variable costs consisted of feed and man labor. The value of the manure produced was credited to the animals. The following table gives a summary of the net costs obtained in plowing one hectare of land with the different sources of power:

Summary of the amounts and cost of plowing with tractors, horses, and oxen.

Source of power.	Work per hour.	Cost of plowing per hectare.			
		1919	1920	1921	
				Jan. 1 to May 1	May 1 to Aug. 31.
	Hectares.	Francs.	Francs.	Francs.	Francs.
Fordson tractor with 2 bottom Oliver plows.....	0.18	114.88	152.19	151.81	138.18
2 horses with Brabant plow.....	.06	61.17	77.48	65.17	74.73
2 horses with Benceronne plow.....	.06	66.86	84.14	70.77	81.16
2 oxen with Brabant plow.....	.05	74.43	91.25	78.82	97.25
2 oxen with Benceronne plow.....	.05	66.69	83.53	72.17	89.04

An attempt at agricultural colonization, A. BECKERICH (*Jour. Agr. Prat., n. ser., 38 (1922), No. 31, pp. 109-111*).—It is noted that progress has been achieved in colonizing vacant farms in France with peasant cultivators. Out of 635 small farms designated as vacant in 1921, 400 have been taken up for this purpose.

Farm and terminal market prices: Wheat, corn, and oats, crop movement year 1920-21, J. W. STROWBRIDGE (*U. S. Dept. Agr. Bul. 1083 (1922), pp. 58, figs. 30*).—The object of this compilation was to ascertain a fair estimate of the average value per bushel of the entire crop of these grains rather than of a specified grade. Each of the tables has been divided into two sections, one of which gives cumulative data in 12 steps, each step being a complete summary from the beginning of the crop movement year to the end of the period, and the other monthly data, complete for each month. A grain marketing chart is given to illustrate price-determining conditions at surplus producing and consuming points. Graphs and maps illustrate the tabulated data.

As for the method of computing prices, farm sale prices for the first day of each month as received by the Department of Agriculture and averages of the county returns of each State are taken. The average State price is used in computing the average price for the combination of States for each market, the estimated monthly sales of the States being used as weights. To allow for changes that may occur in the farm price during any given month, the reported price for the first day was added to that for the first day of the following month and the result divided by two. The terminal market prices were com-

puted from the reported daily cash sales as published by the trade journals for the principal markets. All grades are included for each class price and all classes for the total average price. The prices are computed by multiplying the reported sale price per bushel by the number of cars sold, totaling the number of cars and the extensions of all sales made, and dividing the total of the extensions by the total number of cars.

The Minneapolis receipts as published indicate that 14.5 per cent of the total estimated wheat crop of the United States is received at that terminal. The widest differences between farm and terminal sale prices are found to occur there. The St. Louis market shows the narrowest margin between farm and terminal sales. The cumulative tables for the combined markets show that 68.6 per cent of the total sales from the farm had been made by the end of January, 1921, at an average price of 197.1 cts. per bushel. The terminals for the same period made 67.6 per cent of their total wheat sales at an average price of 214.6 cts. per bushel. The total number of cars reported sold during the year on the four markets, Minneapolis, Kansas City, St. Louis, and Chicago, represents about 17 per cent of the total estimated quantity of wheat produced in the United States, with a weighted average price per bushel of 193.3 cts. compared with 176.1 cts., the average farm price for the 10 States used in these tables.

At the six markets, Chicago, Minneapolis, St. Louis, Omaha, Kansas City, and Cincinnati, 48,348 cars of oats were sold at a weighted average price of 49 cts. per bushel, as against an average farm price of 45.3 cts. for the 12 oat States. The average price paid at the same six terminals for corn was 57 cts. per bushel, with 47.3 cts. the average farm price in the nine corn States. The average difference between farm and terminal price per bushel on the total estimated crop of wheat was 17.2 cts., corn 9.7 cts., oats 3.7 cts., and on the combined crops 9.6 cts. The total farm value of the three crops is 87.5 per cent of the terminal value.

Farmers' Market Bulletin (*North Carolina Sta. Farmers' Market Bul.*, 9 (1922), Nos. 55, pp. 8, figs. 2; 56, pp. 8; 57, pp. 11).—In the first of these three numbers certain points with regard to feeding and marketing hogs are emphasized. The second notes the campaign started by the State extension service for more farm fencing for live stock. Other brief notes with reference to the markets are included, and in each number there is presented the usual monthly partial list of products which farmers have for sale.

Regulations of the Secretary of Agriculture under the United States Warehouse Act of August 11, 1916, as amended July 24, 1919.—Revised regulations for cotton warehouses, approved June 23, 1922 (*U. S. Dept. Agr., Off. Sec. Circ.* 158 (1922), pp. 37).—These regulations, approved June 23, 1922, are amendatory of and intended to supersede the rules and regulations approved September 15, 1919, and the amendments thereto. The text of the act is appended.

Regulations of the Secretary of Agriculture under the United States Cotton Futures Act (*U. S. Dept. Agr., Off. Sec. Circ.* 159 (1922), pp. 40).—A draft is made of revised regulations, effective August 1, 1922, which supersedes earlier ones (*E. S. R.*, 41, p. 492). The text of the act and amendments is appended.

The Packers and Stockyards Act, G. C. SMITH (*Natl. Assoc. State Marketing Off. Proc.*, 3 (1921), pp. 24-28).—The act is summarized, and the provisions of the packers' Consent Decree are given.

Economic aspects of the Great Lakes-St. Lawrence Ship Channel, R. S. MACELWEE and A. H. RUTTER (*New York: Ronald Press Co.*, 1921, pp. 291, pls. 6, figs. 50).—The local and national advantages of this project from the standpoint of agricultural, mineral, and industrial development are set forth

in this report, which is mainly a coordination of the information with regard to the costs of, and the areas that would be served by, this new route, as presented at hearings before the International Joint Commission.

Environment in the history of American agriculture, A. P. BRIGHAM (*Jour. Geogr.*, 21 (1922), No. 2, pp. 41-49).—This is a discussion of the factors influencing changes in the agriculture of given older regions, localization in the production of a particular crop, and the development of new agricultural regions. It is concluded that natural factors (including climate), conditions of population and market demand, with developed transportation, devices for preserving, hereditary and personal aptitudes, and the historical maturity or youth of a region all go into the determination of the detailed and special distribution of crop products.

Effect of the embargo on agriculture, W. W. JENNINGS (In *The American Embargo, 1807-1809, with Particular Reference to its Effect on Industry. Iowa Univ. Studies Social Sci.*, 8 (1921), No. 1, pp. 182-203).—The American embargo of 1807-1809 is discussed in this chapter of a detailed historical study from the point of view of its effect upon agriculture, under the heads of price of produce, value of real estate, payment of debts, speculation, and the general effect on the various sections of the country. It is held that this embargo injured agriculture and the farming class as a whole. Prices of agricultural products decreased, imported articles increased in price, land and slaves depreciated in value, mortgages were foreclosed or stay laws were forced through, speculators thrived by buying up products from farmers at low prices, and money lenders obtained exorbitant interest.

A short history of British agriculture, J. ORR (*London: Oxford Univ. Press, Humphrey Milford, 1922, pp. 96, figs. 28*).—This is a sketch of British agricultural history beginning with Roman Britain and early England and including the growth and decay of the manor system, the beginning of modern farming and early efforts to improve live stock, the inclosure movement and the passage and repeal of the Corn Laws, the period of development and progress from 1830 to 1876, reverses of 1879-1906 due principally to the development of farming in the colonies and foreign countries, and the effects of the recent war.

A report of a mission to Burma, G. CAUSSIN (*Mission Économique Française aux Pays Étrangers Circonvoisins de l'Indochine. Rapport de Mission sur la Birmanie. Saigon: Chambre d'Agr. Cochinchine, 1921, pp. 59*).—Observations reported upon here included the climate, agricultural resources, principal crops, methods of cultivation, crop conditions, and methods of sale of the agricultural products of Burma.

Possibilities of agricultural development in the Punjab, P. J. FAGAN (*Young Men India*, 33 (1922), No. 6, pp. 317-330).—In these pages is discussed the need of education for farmers and further research in agricultural problems, improvement in agricultural methods, increase in the area under irrigation, discouragement of fragmentation of holdings, development of dairying, more intensive use of good land, and closer cooperation.

The agriculture of the Upper Peninsula: Its present development and possibilities, J. W. WESTON, D. L. McMILLAN, and G. W. PUTNAM (*Michigan Sta. Spec. Bul. 116* (1922), pp. 82, figs. 50).—This is a compilation of data from census reports, from other official sources, and from observations and experiments by county agricultural agents and articles contributed by representatives of the college. The climate, soils, field crops, opportunities for live-stock production, fruit growing, and truck crops of this region are described in detail.

Safety in cooperative organizations, C. J. BRAND (*Jour. Amer. Bankers Assoc.*, 14 (1922), No. 12, pp. 755-759, figs. 5).—Three types of cooperative enterprises for marketing agricultural products are described as the independent farmers' marketing unit, the federated organization made up of

individual units, and the large central association which deals directly with individual growers on the basis of a long-time marketing contract. It is held that these organizations should be built up around a single commodity or group of closely related crops, that the local units should be completely organized and constitute the foundation of the marketing structure, and that no organization should speculate in the grower's crops. Difficulties of maintaining successful management and loss of contact with growers and with the community, as well as the greater risk of financial catastrophe, are pointed out as disadvantages of large-scale centralization. The two types, characterized, respectively, by centralized and decentralized control, are compared impartially.

Rural organization.—A study of primary groups in Wake County, N. C., C. C. ZIMMERMAN and C. C. TAYLOR (*North Carolina Sta. Bul.* 245 (1922), pp. 42, figs. 9).—An investigation was carried on in cooperation with the U. S. Department of Agriculture during the two years 1920-21 and 1921-22 in Wake County, N. C., for which the school-teachers were asked to locate the farm families on a county map so as to indicate how they group themselves in communities. Certain primary geographic population groups organized usually about an institution were thus discovered, but when further analyzed the geographical factor was found to be less determining than the institutionalized social and economic factors. Many of these communities overlapped.

Chapters 1 and 2 of this bulletin give an account of the county as a whole and the five kinds of service centers found there, namely, urban trade towns, retired farmer villages, farm operator villages, the open country store-school-church-lodge center, and the isolated open country church-school-store center. Nine maps are given showing the number and location of these centers, the originally determined white and negro communities, and the institutions.

Chapter 3 discusses the rural primary or neighborhood groups of the county surveyed. It is held that rural community organization is functional and discriminating rather than local and geographical, and that correct community organization must be projected as a series of institutional programs. The most pliable and progressive form of rural organization seems to be the educational one brought about through the rural school. Definite areas heretofore called "no man's land" do not exist in Wake County. Numerous sociological rural communities were found, but they do not cover specific and exclusive geographic areas.

Chapter 4 contains generalizations concerning rural organization as found by this survey.

AGRICULTURAL EDUCATION.

[Rural education at the fifty-ninth annual meeting of the National Education Association, July 3-8, 1921] (*Natl. Ed. Assoc. Addresses and Proc.*, 59 (1921), pp. 352-362, 523-616, 694-701, fig. 1).—Outlines of reports to the committee on rural education of the National Council of Education are given here on consolidation of schools, rural recreation and social life, and tests and measurements in rural schools, as well as a report of the committee on comparative instruction in one-teacher and consolidated rural schools, by J. M. Foote; of the committee on the distinction between administration and supervision of rural schools, by F. W. Dunn; of that on the preparation of rural teachers, by M. Carney; and on a working program for Smith-Lever extension and vocational education forces in various States, by A. R. Mann. Papers included are Improving Rural Schools by Standardization, by E. A. Lathrop; Can Adequate Financial Support Be Secured for Rural Schools? by G. L. Towne; The Waitsfield Experiment, by M. Dana; Training County Superintendents and Rural Supervisors in Service, by A. M. Ayer; Supervision for

Growth, by M. Newbury; Financial Support for Rural Schools, by N. R. Baker; Some Fundamentals of Rural Community Organization, by D. Sander-son (E. S. R., 46, p. 895); The Continued Emergency in Rural Teacher Supply and How to Meet It, by E. A. Lathrop; Initial Steps in the Development of Rural Education Departments in Normal Schools, by H. S. Browne; Stimulating Interest in Vocational Agriculture Through Junior Project Work, by J. D. Blackwell (E. S. R., 46, p. 897); Stimulating Interest in Vocational Agriculture Through Junior Club Activities in the Schools, by F. H. Clark (E. S. R., 46, p. 897); Boys' and Girls' "Four H" Clubs and the School, by W. H. Kendrick (E. S. R., 47, p. 496); To What Extent Should Rural Teachers Participate in Making Courses of Study? by W. J. Holloway; The Course of Study in Montgomery County, by N. E. Brogden; Principles Underlying the Rural Elementary School Curriculum, by F. W. Dunn; The Preparation of Teachers for a Democratized Rural School, by R. Root; Supervision for Growth, by C. R. Spencer; Rural School Democracy Through Efficient Administration, by A. S. Cook; Community Service of the Democratized Rural School, by W. W. Evans; The Negro in Rural Education and Country Life, by J. H. Dillard; Platform of the Department of Rural Education of the National Education Association, by L. L. Irivier; The Relation of the Village to the Rural School Administration and the County Unit, by G. A. Selke; Consolidated Schools in Middle Western States, by G. S. Dick; A National Program for Consolidation, by M. Campbell; The Aims of Rural Education, by W. C. Bagley; and The Rural School—The Great Problem in American Education, by E. Burnham.

The present status of home economics education, F. WILLIAMS (*Jour. Home Econ.*, 14 (1922), No. 6, pp. 255-258).—It is held to be evident that the movement for the scientific measurement of results in home economics as evidenced by attempts at the construction of standardized scales and tests is established, and that the content of home economics courses of study is being critically scrutinized. The economics of buying and nutrition are the topics that are receiving the most attention in many schools.

Continuation schools and school questions, HOLM (*Gartenwelt*, 26 (1922), No. 14, pp. 138-141).—The author urges the importance of practical education for gardeners in the maintenance of the German food supply independently of imports and outlines a scheme of special vocational schools. He includes continuation schools exclusively for teaching the fundamental principles underlying gardening, to be carried on either in connection with vocational schools or agricultural or winter schools or alone, but in any case supported professionally by gardeners. Others are short-course winter garden schools for the larger cities, gardening schools with four- or five-year courses, and schools for training teachers.

Agricultural education in Poland (*Ireland Dept. Agr. and Tech. Instr. Jour.*, 21 (1922), No. 4, pp. 491, 492).—Under the act of July 15, 1920, the great agricultural estates of Poland are to be divided up and help given to the farmers in establishing themselves on land acquired by agreement or by compulsory purchase. The Ministry of Agriculture is entitled to reserve lands or buildings suitable for agricultural training centers. Under a special act of July 9, 1920, public and private popular training centers are provided for, and the Ministry of Agriculture is charged with supervision of the curricula. Two centers, one for boys and one for girls, must be established in each district, and for the support of these the State will rent to district authorities and chambers of agriculture a free grant of land for the training center and model farm; will allocate to them a sum for building purposes equal to one-fourth of the amount of the estimate approved by the minister of agriculture, advancing one-half of the total estimate as a long-term loan at 3 per cent interest, and will provide the teachers' salaries.

Report of the Women's Institutes of the Province of Ontario, 1920 and 1921 (*Ontario Dept. Agr., Women's Insts. Ontario Rpt., 1920-1921, pp. 99, figs. 3*).—Addresses and reports of standing committees, presented before conventions of the women's institutes during 1920 and 1921, are published here, together with excerpts from reports of representative institutes. Suggestions are to be found with reference to program planning, girls' institutes, how to conduct a meeting, and books for use in women's institutes.

Motion pictures of the U. S. Department of Agriculture, F. W. PERKINS (*U. S. Dept. Agr., Dept. Circ. 233 (1922), pp. 13*).—A list of titles of films available for distribution by the Department is published here. These are arranged under the names of the bureaus that are authority for the subject matter, accordingly as they pertain to animal industry, plant production and diseases and pests, game protection, forestry, extension work, entomology, marketing, public roads, habits of animals, and dust explosion.

Corn judging, R. A. MOORE and G. B. MORTIMER (*Wis. Agr. Col. Ext. Circ. 152 (1922), pp. 31, figs. 15*).—An explanation of the points given in the Wisconsin official corn score card is made here, and certain of Wisconsin's best varieties of white and yellow corn are briefly described. The steps in the method of procedure in corn judging are given as learning first the points on the score card and second the characteristics of standard types and varieties of corn and scoring samples.

Live stock judging contests, J. H. SHEPPERD (*North Dakota Sta. Bul. 157 (1922), pp. 3-30, figs. 4*).—Part 1 of this bulletin is an account of the history of student live stock judging work in this country from about 1892. Part 2 gives some sample calculation sheets and forms and sets forth methods developed at the International Live Stock Exposition judging contests.

A clothing project, B. BLACKMORE (*Jour. Home Econ., 14 (1922), No. 9, pp. 430-432*).—The outline of a method of organizing a clothing project drawn up here is intended to present to teacher-training classes the advantages of accuracy, with flexibility in giving instruction in clothing.

MISCELLANEOUS.

Report of the director, 1921, P. F. TROWBRIDGE (*North Dakota Sta. Bul. 159 (1922), pp. 44, figs. 6*).—This contains the organization list, a report of the director on the work of the station and the various substations, and a financial statement for the fiscal year ended June 30, 1921. The experimental work reported is for the most part abstracted elsewhere in this issue.

Report of Edgeley Substation, 1921, O. A. THOMPSON (*North Dakota Sta. Bul. 161 (1922), pp. 12*).—This bulletin contains meteorological data and brief summaries of the lines of work at this station. The experimental work reported is for the most part abstracted elsewhere in this issue.

The mathematical theory of probabilities, A. FISHER (*New York: Macmillan Co., 1922, vol. 1, 2. ed., enl., pp. XXIX+289, figs. 6*).—This is volume 1 of this work, which has been translated from the Danish by C. Dickson and W. Bonyng, with introductory notes by M. C. Rorty and F. W. Frankland. It deals with the mathematical theory of probabilities and its application to frequency curves and statistical methods.

Collection of coefficients and equivalents (*Récueil de Coefficients et d'Équivalences. Rome: Inst. Internatl. Agr., Serv. Statist. Gén., 1922, 4. ed., pp. 191*).—Part 1 lists by countries coefficients for the conversion of moneys, weights, and measures to the corresponding units of the metric system. Part 2 contains tables of equivalents for the principal English and American measurements expressed in terms of the metric system; and part 3, formulas for the conversion of the moneys of certain countries into terms of that of certain others.

NOTES.

Alaska College.—The college opened its doors September 18, 1922, with an enrollment of six students, but this number has now been increased to 12, besides several in a miner's short course. A farmers' short course was offered in January.

California University and Station.—Dr. F. W. Woll, professor of animal nutrition since 1913 and widely known as a writer on animal feeding and dairy subjects, died December 6, 1922.

Dr. Woll was born in Bergen, Norway, May 23, 1865, and received the degree of Ph.B. from the Royal Fredericks University, Christiania, in 1883. Later the M.S. and Ph.D. degrees were conferred by the University of Wisconsin, in 1886 and 1904, respectively. In 1887 he was appointed chemist in the Wisconsin Station, studying among other things, sugar beet growing in Wisconsin under Dr. H. P. Armsby. His major interest, however, was in dairying, and he became greatly interested in feeding problems, especially the use of silage, and also in dairy contests and advanced registry. He was appointed station chemist in 1897, and in 1906 also professor of agricultural chemistry, holding these positions until his appointment in California.

Dr. Woll was the author of many works, each of which has been reissued in several editions. Among these may be mentioned *A Book on Silage*, *A Handbook for Farmers and Dairymen*, *Testing Milk and Its Products* (with E. H. Farrington), *Productive Feeding of Farm Animals*, and *Feed Manual and Note Book*. He also prepared *A Translation of Modern Dairy Practice* (from the Swedish of G. Grotenfelt), and for various periods from 1903 to 1914 served as an abstractor of Scandinavian literature for *Experiment Station Record*. He was an extensive contributor to both technical publications and agricultural and dairy papers.

The marked development of interest in the cow testing associations in California is largely attributed to his efforts. He was a member of many agricultural and scientific societies, including the Society for the Promotion of Agricultural Science, the American Society for Animal Production, the Association of Official Agricultural Chemists (president, 1910-11), and the American Dairy Science Association.

Illinois University and Station.—J. G. Mosier, chief of soil physics, died November 11, 1922, at the age of 60 years. Professor Mosier was graduated from the university in 1893 and served as assistant in the department of geology for the three following years. After three years in high school teaching he became interested in scientific agriculture and was appointed instructor in soil physics in the university in 1902. In 1911 he became professor of soil physics in the college of agriculture and chief in soil physics in the station. For 20 years he was in charge of the classification of the soils of the State in connection with the State soil survey of the university, and was considered an authority on this subject. He was also widely known as a farmers' institute speaker, and was the author of two textbooks, *Soil Physics and Management*, and *Soils and Crops*, besides many bulletins and papers on agricultural subjects.

Kansas College.—The college is requesting appropriations aggregating \$1,140,400 for the fiscal year 1923-24 and \$1,080,400 for the following year. This is a total of \$150,000 less than was granted by the legislature for the

present biennium. Efforts have been made to operate as closely as possible on a maintenance basis. The principal new items are \$59,000 each year for additional teachers, \$25,000 each for emergency repairs and the remodeling of the dairy building, and \$5,000 annually for the soil survey. In addition \$109,350 is being asked for the four substations. One serious difficulty confronting the institution is the heavy reduction in its receipts from the sale of farm products, the amount falling from \$120,815.87 in 1919-20 to \$66,670.11 in 1921-22.

Michigan College and Station.—The college is asking for appropriations for the ensuing biennium aggregating \$4,600,000, about equally divided between annual operating expenses and new buildings and equipment. The estimates include \$50,000 as a special fund for research projects, \$400,000 for a new horticulture building, greenhouse, and equipment, \$500,000 for a new chemical laboratory, \$250,000 for two dormitories for women, and \$50,000 for an addition to the veterinary science building.

Pennsylvania Station.—W. R. Gordon has been appointed assistant professor of rural sociology extension, effective December 11, 1922.

Association of Official Agricultural Chemists.—The thirty-ninth annual convention of the association was held November 15-17, 1922, at Washington, D. C., with a registration of about 360.

In addition to the usual reports of the referees and associate referees, the following papers were presented: The Effects of Cropping Upon the Active Potash of the Soil, by G. S. Fraps; The Determination of Starch Content in the Presence of Interfering Polysaccharids, as in Impure Linseed Products, by G. P. Walton; Nickel Apparatus in the Analytical Laboratory, by L. O. Whaley; Volumetric Determination of Phosphoric Acid, by W. A. Turner; Availability of Absorbed Potash as Indicated by Chemical and Pot Tests, by N. E. Gordon; A New Fertilizer Sampling Tube, by L. D. Haigh; Data Secured on the Turbidity Point, by A. Seidenberg; Determination of Zinc and Copper in Gelatins and Glues, by R. Hertwig; Analyses of Recent Samples of Cacao Beans and Their Significance, by W. C. Taber; A Preliminary Report of the Presence of Primary Amins in Canned Mushrooms, by C. E. Joblonski; Domestic Sources of Cantharidin, by A. Viehoever and R. G. Capen; Quantitative Determination of Acetic Anhydrid, by G. C. Spencer; and Sublimation as a Method Applied to Various Products, by J. Hortvet.

In connection with the papers and reports of referees on feeds and feeding stuffs, H. S. Balley of the Society of American Oil Chemists brought before the association the work which is being done by this society in an effort to improve the technique of the analysis of feeding stuffs through the distribution of cotton seed and other feed meals for collaborative determinations of moisture, gasoline-soluble material, and ammonia. At present about 75 collaborators are enrolled in this work. These receive at frequent intervals samples for analysis and in return report their results to the society. From the results received weighted averages are calculated and reported to the individual collaborators.

The program of the second day included the address by the retiring president, F. P. Veitch, who spoke on The Opportunities and Responsibilities of the Association of Official Agricultural Chemists. Brief addresses were also given by H. W. Wiley, the honorary president of the association, and by Senator E. F. Ladd who, at the 1921 meeting, was made a life member of the association. On Friday morning the Secretary of Agriculture addressed the association, discussing briefly the agricultural situation at the present time and outlining the steps which have been taken by the Department to assist the agriculture of the various regions of the country through the establishment of commodity councils.

Following the reports of the standing committees, R. W. Balcom, chairman of the board of editors of the *Journal*, made an urgent plea for an increase in subscriptions to the *Journal* among the members of the association. In the report of the committee on editing methods of analysis, R. E. Doolittle announced that a new edition of the Official methods would probably be published shortly after the 1923 meeting. The association authorized the joint publication with the American Public Health Association of a book of methods on milk analysis in which are to be incorporated the methods of chemical analysis of milk as found in the present Official methods.

The officers of the association for the coming year are as follows: President, A. J. Patten; vice-president, R. E. Doolittle; secretary-treasurer, W. W. Skinner; and additional members of the executive committee, E. M. Bailey and P. B. Dunbar. In closing, resolutions were adopted on the death of Dr. Frear, a long-time member of and active worker in the association.

West Indian Agricultural College.—This institution was formally opened October 16, 1922, by Sir Samuel Wilson, governor of Trinidad and Tobago. Quarters have been provided in a temporary building erected at St. Augustine, Trinidad, and bids have been asked for the permanent building. A total of 18 students have been enrolled, of whom 3 are graduate students.

The Imperial Department of Agriculture of the West Indies has been transferred from Barbados to Trinidad and merged with the college.

Necrology.—The death is noted of Dr. F. Nobbe on September 15, 1922, at the age of 92 years. For 44 years Dr. Nobbe was editor of *Die Landwirtschaftlichen Versuchs-Stationen*, his service covering volumes 3 to 60. With the help of the Dresden District Agricultural Society he established at Tharand, Saxony, an experiment station for plant physiology in 1869, and in the same year and place the first seed control station. In association with Hiltner, he gave much study to the organisms connected with the assimilation of nitrogen by legumes and did much to develop the water-culture method of studying plant nutrition. Upon the formation of the Association of German Experiment Stations in 1888, he became its first president. He retired from active service in 1905.

Gaston Bonnier, member of the Academy of Sciences of France, professor of botany at the Sorbonne, director of the Plant Biological Laboratory at Fontainebleau, and founder and editor of *Revue générale de botanique*, died in Paris December 30, 1922, aged 69 years. His work on the vascular development of the higher plants, respiration of fungi, and the acquisition of characters under climatic influences, is well known to botanists. In his work on acquired characters the study involved about 165 species of plants that were grown at different elevations, from sea level to 2,400 meters (about 1.5 miles) above the sea.

Dr. Hiram T. French, a pioneer in agricultural education in the West, died at Corvallis, Oreg., November 5, 1922, after a sickness of two years.

Dr. French was born at Almena, Mich., October 1, 1861. He was graduated from the Michigan College in 1885 and was given the degree of M. S. in 1888, and subsequently the honorary degree of D. Sc. by the same institution. He began his work in the West at the Oregon College in 1889 as professor of agriculture, going 10 years later in a similar capacity to the Idaho University. In 1903 he was appointed director of the Idaho Station, serving until 1909. From 1913 to 1915 he was State leader of county agent work in Oregon, and from 1915 to 1921 director of extension in the Colorado College. He was well known as a writer and speaker, and among other works prepared a 3-volume *History of Idaho* in 1913-14.

EXPERIMENT STATION RECORD.

VOL. 48.

FEBRUARY, 1923.

No. 2.

There was one notable address at the last convention of the Association of Land Grant Colleges which unfortunately will not be published in the proceedings, because it was delivered informally and was not reported. The speaker was Dr. R. S. Woodward, the former president of the Carnegie Institution of Washington, and his subject was The Varied Aspects of Research. It was presented before the section of engineering, but much if not most of it applied to research in general rather than specifically to engineering.

While the essential attributes of research were dealt with quite broadly in this address, the consideration centered in large degree around the matter of administration. There was a note of warning and a suggestion of danger in the mistaken view that the research of a scientific institution needs no centralized guidance, and that a business administration may be all that is necessary. To the man of affairs the kind of administration needed is not fully apparent, and he is likely not to understand the service it can perform.

Dr. Woodward emphasized in strong terms the exceeding importance of administration in research, and he made it clear that this meant far more than attention to the fiscal and clerical side of an institution. He referred to the fact that governing boards of institutions are likely to see only these phases, and hence sometimes conclude the administration may safely be placed in the hands of a good business head. Such a view, it will be recognized, overlooks the importance of the development of wise research policy, the outlining of the field, the selection of men, and the intelligent provision of conditions essential to their highest success; and it fails to grasp the relationship and influence which a broad minded, sympathetic man of technical knowledge may maintain in connection with the furthering of inquiry.

Failure to appreciate the place of administration in a research institution has not been confined to governing boards. It has been shared to some extent by investigators. In contending for freedom and opportunity for the individual in following out the ideas which come to him in connection with his studies, administration has sometimes been scouted as having small place in connection with research and even inimical to it if carried beyond the office details. This is an extreme view, and the danger hinted at is essentially hypothetical as far as present conditions go. However, the indorsement of the value and essential qualities of administration, coming from such a

source as the distinguished speaker, is reassuring and is entitled to carry much weight. The fiscal and clerical side of administration is given such prominence by some officers that trustees may not be without reason in their misconception.

The experience through which the experiment stations have passed has represented a changing viewpoint in this matter. It will be recalled that in the early history of the stations a practical man of affairs, a leading farmer, someone in close touch with practice rather than investigation, was often given the preference in the selection of a director. Familiarity with the ways of the art overbalanced experience in the ways of investigation. If there was to be guidance its purpose was to hold the worker to practical matters, to see that results were secured quickly, and to prevent straying too far into the field of the abstract. It was not appreciated that "the achievements of Nature may be of less importance than the methods by which she works." There was a time also when the only administration thought necessary was such as the president of the college could supply.

Gradually, however, these stages passed and men of broader outlook in science came to be chosen to head the stations. We seemed to be developing a special type of executive, trained in research and permitted to center his attention mainly on the station. But he proved too valuable to the college as a whole and was elevated to the position of dean, although frequently retaining the directorship. It was a natural consequence that when the colleges began to take on growth and to add to their courses and their faculties and their quota of special buildings, the administration of the stations sometimes became secondary. To some extent also the primary interests of the college influenced the type of man selected for the dual office of dean and director, or limited the kind and amount of administration available for the station.

It was inevitable that these changes should have their effect, especially when a new and rapidly developing branch of extension came into being, with all its potentialities for good and for supplying a new set of problems. It is worth while, therefore, to consider the importance of providing the right kind and the desirable amount of attention to the station affairs, and to frankly acknowledge the importance of it in continued advancement.

In elaborating the character of administration called for in research, Dr. Woodward drew attention to the different types of activity which are likely to be involved—the theoretical and abstract as well as the practical and applied. These can no longer be sharply divided. The fundamental research can not be done in one place or in one set of institutions, and the applied research in another. The idea that it might be was referred to as an old fallacy which has persisted in some classes of institutions. It will be recalled that

such a view had a considerable following in the experiment stations not so long ago. But the two types of effort have steadily grown closer together, so that all investigation of the present day, even though it aims directly at applications, must involve fundamental and abstract inquiry before it proceeds far. It is only the simpler forms of experiments and observations that hold aloof from the fundamental stage, and are content to be only comparative and remain in the empirical field.

Hence the administrative officer must deal with the two types, which requires a broad intimacy with the general status of science; and the extent to which the more exacting type of inquiry is developed in an institution will reflect in no small degree the attitude and judgment of its administrative head. For upon him rests largely the selection and development of the staff of workers, and the intelligent direction and encouragement he gives may in quite large measure determine their course. A research policy without competent workers to execute it is an anomaly; and on the other hand, a corps of ambitious investigators whose efforts are not supported by an intelligent and aggressive research policy will labor under a severe handicap.

In this connection Dr. Woodward strongly stressed the significance of the attitude of the administrator toward the investigator. He held the fundamental principle of administration to be very simple—that the way to get good work done was to commit it to a good man and give him freedom and sustained support. But he made it clear that this involved something more than a passive relationship, a *laissez-faire* attitude toward the worker and what he was doing. It implies, as he pointed out, an attitude of sympathy, encouragement and expectation; but it will hardly be contended that it means the granting of unlimited freedom and liberty to the specialist to follow at random wherever his inclinations may lead. Much less is this the case in a publicly supported institution.

Mention was made of the lack of experience in research by administrative officers which sometimes occurs. There may be a general appreciation of research, but scant familiarity with what really is involved in working out a scientific problem. In such cases the advantages and possibilities of investigation are likely to be the main consideration, while the difficulties are only dimly appreciated. This may make such officers "reckless of time and patience and cost in order to get results." They may misjudge the real advance which is being made on the one hand, and fail to detect unproductive efforts on the other. Training and insight which enable the exercise of critical judgment in these matters means much, and supplies a safeguard which may need to be exercised toward proposals by the staff as well as toward suggestions which come to the administering

head. If the executive function is to be properly carried out it is clear that there must be sufficient time available for this weighing and evaluation of the efforts already under way, as well as of new proposals and new lines of development.

These things are a part of good business administration and wise economy, for while the administration of research must be liberal, be characterized by a generous measure of confidence and freedom and support, it ought, as Dr. Woodward said, to aim to secure the maximum efficiency at the minimum cost. This is obviously the case in a public institution where the interest of the people is involved, but it applies likewise to endowed enterprises. Although the latter are not directly answerable to the public for their stewardship, they are indirectly responsible to science and ultimately to mankind for the record they make, and they will be judged in that light. Research is one field in which responsibility for the use to which resources are put can not be shunned. It is not a private affair. The ultimate concern of the public in it wherever done is expressed in Dr. Woodward's declaration that no other field of human endeavor has been so fruitful or so lasting. It has even "outlived the great literary efforts of the past."

It will hardly be questioned that administration is still one of the large factors in connection with the success of the experiment station. It has a place of no secondary importance to play in the constructive planning of the station's course and the effective conduct of its various grades and types of activity. In the last analysis it is largely responsible for the direction of the station resources along most profitable channels. The only question then is whether this guidance and supervision of station affairs is ample, and whether these functions are being as fully exercised as they may profitably be.

The part which administration plays does not interfere with the proper functions of the technical workers. It may serve as a stimulus, and at times it may impose restraint, but it exercises a steadying hand and it preserves the idea of the station as a whole. The purpose of organization and administration is to secure the most effective employment of the various forces and resources of the station, some of which are shared with other branches, in lines of effort which have been determined upon after careful consideration. The object is not the direction of the researches in the sense of supervision, dictation or interference with their orderly conduct, but it may properly concern itself with their course and progress in order to intelligently determine their needs and the extent to which support is justified, and it may look ahead to prepare for further developments.

In itself administration is warranted only in so far as it serves a useful end, but long years of experience have shown that it has a sound basis for an active existence. It is its business to preserve the

objects and aims of the station, to keep matters moving in the various departments in an orderly and active way, to stimulate and encourage, to sustain and protect, and to counsel and suggest where these are necessary.

The maintenance of a watchful, even a jealous, eye on the station can only serve to strengthen it and give it a position of greater prominence. It sometimes needs protection, often it can be helped by an advocate who has its interests primarily at heart. It needs representation before the public and to have the things done for it which apply to its organization as a whole, but after these things have been done the greatest chance for benefit probably lies within itself.

The whole objective of the experiment station is intelligence. Its method has been likened to prospecting—prospecting for intelligence. The course in a particular line may prove to be a straight and easy one, or it may turn out to be a tortuous and difficult one, with unforeseen obstacles and frequent disappointments. Someone must exercise a patient and appreciative but no less a critical attitude toward these operations, or there may be vacillation, a marking of time, and wasted effort. Where attention from a responsible administrative head is lacking the course of the station is likely to be haphazard, inadequately considered, not directed by any well developed policy. There is a tendency to undertake more things than can be carried out with the means at hand, for the enthusiasm of individual workers is prone to underestimate difficulties and the necessary expense is likely to lead far beyond that anticipated. There is danger also of an accumulation of undertakings which have fallen into the routine stage and have ceased to be productive toward conclusion. As a whole the work of a station in such a case is not upon the high plane it should be striven to place it.

The director of a station can not be expected to be an expert in all the parts of the station work, but he can know something about them and the elements essential to their success, and eventually he can form a judgment as to how far these are being met. He can of course be familiar with the problems and their relative importance, even though he must rely upon experts to devise the means and carry them out. In the less technical conventional methods which apply to so large a part of the station work he may claim some judgment regarding their competence to advance beyond a certain point, and their adequacy to meet just expectations at the present stage. In the more advanced lines of inquiry he can see that these are properly aimed and well considered at the outset, that the work under them is constructive and not simply routine, and that they are being held to their general purpose. Occasionally he may be called upon to determine when that purpose has been attained, for the disposition to wander and to follow suggestion

from one field over into another delays conclusion after it has been reached, and projects the inquiry far beyond its original field.

With such intimate contact and study the director may hold the station well within its resources and along well considered lines, and he may be able to turn some long standing projects in the direction of progress or toward an early conclusion. In this way he may perhaps be able to stop some leaks, or by eliminating expensive overhead in connection with operations which have become largely routine he may conserve resources and give larger opportunity where it is needed.

The remedy for inadequate funds is not always more money. It may lie in the direction of concentration and conservation, a more effective employment of the existing resources. This is first of all a matter for administrative discovery and remedy. It can best be determined by a general officer who is not personally involved in a particular line and may therefore be less prejudiced. It is a matter for counsel, but for ultimate decision by the administratively responsible head. Decision must be based on an intelligent and sympathetic understanding, and this is the advantage of the man of technical training in the administration of research.

The financial support now received by several of the stations is a large responsibility. It warrants great expectations. The seven and one-half million aggregate reported as being at the disposal of the stations in the forty-eight States is a tremendous endowment for research. No other branch of industry or public welfare enjoys anything like it. It goes without saying that it can not be used judiciously without a considerable amount of planning and administrative attention. Are we sure it is receiving the attention it deserves, and returning in new or more secure and better interpreted scientific information the reasonable expectations to be looked for?

This is a difficult question to answer when so much that is constructive and highly beneficial is being turned out, and one would be slow to venture a broad criticism. But there are indisputable differences in efficiency of different institutions as measured by the amount and character of the returns, even where the support does not vary materially; and there are cases in which administrative attention is reduced to a minimum. The close student may detect some relationships.

Until there is better information in some quarters as to what funds are actually available to the stations, and the use to which these funds are put in constructive inquiry, it will be difficult for those responsible to measure the degree of efficiency or to strengthen their stewardship. The strength of the station system is in its integral parts. The correction of any administrative weakness is a matter of concern to the system as a whole.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

The proteins of the Lima bean, *Phaseolus lunatus*, D. B. JONES, C. E. F. GERSDORFF, C. O. JOHNS, and A. J. FINKS (*Jour. Biol. Chem.*, 53 (1922), No. 2, pp. 231-240).—The studies on the proteins of various beans (E. S. R., 47, p. 407) have been extended to a similar study of the proteins of the Lima bean (*P. lunatus*), the nutritive properties of which have been made the subject of a previous report (E. S. R., 46, p. 564).

The Lima bean meal was found to contain 21.17 per cent of protein (N×6.25), 73.32 per cent of which, or 15.31 per cent of the weight of the meal, was extracted by 3 per cent aqueous sodium chlorid. Nearly as high a percentage of protein was extracted by distilled water as by the 3 per cent salt solution. By fractional precipitation of the sodium chlorid extracts with ammonium sulphate, two globulins were obtained, the α -globulin at 0.25 saturation and the β - at between 0.45 and 0.75 saturation. An albumin, representing 1.75 per cent of the meal or 8.25 per cent of the total protein, was obtained from the distilled water extracts of the bean meal after removal of the globulins. The distribution of the basic amino acids in the α - and β -globulins and albumin, respectively, was as follows: Cystin 1.60, 0.84, and 1.07; arginin 5.67, 5.07, and 5.74; histidin 3.71, 2.62, and 2.54; and lysin 7.84, 8.53, and 5.97 per cent. Both globulins and albumin gave positive tests for tryptophan.

The chemistry of fats, É. ANDRÉ (*Bul. Soc. Chim. France*, 4. ser., 31 (1922), No. 6, pp. 459-525).—This is essentially a monograph on the chemistry of fats. Many references to the original literature are included.

The chemistry of essential oils and artificial perfumes.—II, **The essential oil and its odor; constituents of essential oils, synthetic perfumes, and isolated aromatics; the analysis of essential oils,** E. J. PARRY (*London: Scott, Greenwood & Son, 1922, 4. ed., rev. and enl., vol. 2, pp. VII+365, figs. 10*).—In the revision of the second volume of this work (E. S. R., 42, p. 8), a chapter on the essential oil and its odor and one by T. H. Durrans on the relationship of odor to chemical constitution have been introduced before the sections on the constituents and the analysis of essential oils. The revision of the first volume has been noted previously (E. S. R., 46, p. 308).

The comparative influence of pure and commercial sugars and of combined and separate sterilization on bacterial metabolism, C. G. L. WOLF (*Brit. Jour. Expt. Path.*, 2 (1921), No. 6, pp. 266-275).—Data are presented on the fermentation products of *Bacillus coli*, *B. welchii*, *B. mrisepicus*, and *B. tetani* in lactose and glucose bouillon under the conditions of the use of commercial and of specially purified sugars and of separate and combined sterilization of the media. "While minor differences were encountered, these were not sufficient to indicate that combined sterilization or commercial glucose or lactose would influence a fermentation reaction sufficiently to lead to error. At the same time it must be remarked that with organisms more sensitive than those employed in the present study, it is quite possible that such errors could take place."

A study of the acetone and butyl alcohol fermentation of various carbohydrates, G. C. ROBINSON (*Jour. Biol. Chem.*, 53 (1922), No. 1, pp. 125-154, figs. 10).—Using the methods employed by Speakman in previous studies of the acetone and butyl alcohol fermentation of starch (*E. S. R.*, 44, p. 308), the author has made a systematic investigation of the action of a *Granulobacter* type of organism isolated from a sample of fresh barley on various mono-, di-, tri-, and polysaccharids, with the following general results:

The fermentations obtained were of two types, the first characterized by a decided fall in acidity after the maximum is reached and by the complete consumption of the carbohydrate, and the second by the persistence of a high acidity and by the incomplete destruction of the carbohydrate. The carbohydrates falling in group 1 are glucose, fructose, mannose, sucrose, lactose, and starch, and those of group 2 galactose, xylose, arabinose, raffinose, melezitose, inulin, and mannitol. Dextrin belongs to either group, depending upon the method used in the preparation of the sample. Trehalose, rhamnose, melibiose, and glycerol were not fermented by this organism.

It is concluded that the organism secretes the enzymes amylase, inulinase, and maltase, but does not secrete sucrase, lactase, or raffinase.

The fermentation of hexoses and related compounds by certain pentose-fermenting bacteria, W. H. PETERSON, E. B. FRED, and J. A. ANDERSON (*Jour. Biol. Chem.*, 53 (1922), No. 1, pp. 111-123).—A study is reported from the Wisconsin Experiment Station of the fermentation products formed from the various hexoses and related compounds by Group I of the pentose-fermenting bacteria previously described (*E. S. R.*, 46, p. 503). Four cultures of this group of organisms were used and, for purposes of comparison, a strain of *Streptococcus lactis*. The technique throughout was practically the same as that described in a previous study of the fermentation of hexoses by the Group II strains of *Lactobacillus pentoaceticus* (*E. S. R.*, 43, p. 610).

Glucose, fructose, lactose, raffinose, and melezitose were converted almost quantitatively into lactic acid, which represented 90 per cent or more of the sugar fermented. Of the above sugars glucose and fructose were the most readily fermented. Carbon dioxide was produced in very small quantities, from 0.01 to 0.03 gm. per gram of sugar destroyed. This amount is considered too small to represent a direct fermentation product.

In the fermentation of mannitol, ethyl alcohol, formic acid, and acetic acid were formed in addition to lactic acid, from 10 to 30 per cent of the total products being represented by these three compounds. The lactic acid produced by the pentose-fermenting bacteria was the inactive form, while that produced by the strain of *S. lactis* employed was the active isomer.

Some notes on the enzymes of the avocado, E. M. CHACE (*Calif. Avocado Assoc. Ann. Rpt.*, 1921-1922, pp. 52, 53).—It is briefly reported that the avocado or alligator pear contains a catalase which is present in both the immature and the mature fruit, that oxidase or peroxidase is present in most of the varieties thus far examined, and that emulsin has been found in nearly all of the soft samples examined. Lipase has not been identified as yet.

Quantitative determinations of some of the biochemical changes produced by a saprophytic anaerobe, L. D. BUSHNELL (*Jour. Bact.*, 7 (1922), No. 4, pp. 373-403, figs. 2).—This contribution from the Kansas Experiment Station consists of a report of an extensive quantitative study of the biochemical changes brought about in different culture media by an anaerobic organism isolated from spoiled canned asparagus and which, from preliminary qualitative tests, was thought to belong to the *Bacillus sporogenes* group. With a view to comparing this organism with other similar anaerobes, determinations were made of the amount and kind of gas and acids produced from various

carbohydrates and the amount of proteolytic action as determined by formation of ammonia and amino acids. The technique and apparatus employed are described in detail, and tables are given of the analytical data obtained.

In general the quantitative results compared favorably with the qualitative, but did not furnish much additional information. It is thought, however, that the data may prove of value for future comparisons with other forms which may be investigated later.

The use of mixed indicators, A. COHEN (*Jour. Amer. Chem. Soc.*, 44 (1922), No. 9, pp. 1851-1857).—Attention is called to the possibility of using a mixture of two or more of the sulphonephthalein indicators in place of single indicators to obtain a better color indication for a given colored medium, to effect an apparent displacement of the color changes of an indicator in either half of its working range to the other, and to serve as an apparently new indicator with any special range desired. To illustrate these three points, three mixed indicators are described and their particular value discussed. These include (1) a mixture of equal volumes of bromothymol blue and bromocresol purple, (2) a mixture of equal volumes of 0.04 per cent solutions of bromocresol purple and bromophenol blue, both as their sodium salts, and (3) a mixture of equal volumes of a 0.04 per cent solution of bromophenol blue and a 0.02 per cent solution of cresol red, both as the aqueous monosodium salts.

A study of certain protein precipitants, A. HILLER and D. D. VAN SLYKE (*Jour. Biol. Chem.*, 53 (1922), No. 2, pp. 253-267, figs. 2).—To determine the relative value of various precipitants for the separation of proteins from their hydrolysis products, seven typical reagents, namely, tungstic acid, picric acid, metaphosphoric acid, colloidal iron, alcohol, mercuric chlorid, and 2.5, 5, and 10 per cent trichloroacetic acid were used with blood peptone solution, blood plus peptone, and blood plus amino acids. The completeness of precipitation was estimated by determinations of the relative proportions of total nitrogen precipitated and of the total nitrogen, amino nitrogen, and peptid-bound nitrogen in the filtrates. The blood urea was destroyed with urease before the precipitants were used, and the ammonia was removed after precipitation by vacuum distillation of the filtrates. The general results obtained may be summarized as follows:

With Witte's peptone, tungstic acid and picric acid precipitated the protein intermediate products with relative completeness without precipitating the amino acids, while trichloroacetic acid, particularly in dilute solutions, did not precipitate these products. "It appears, therefore, that trichloroacetic acid is especially fitted for use with solutions of partially digested proteins when it is desired to remove the proteins and to regain in their filtrates not only the amino acids but also a maximum proportion of the intermediate products, such as 'albumoses' and 'peptones.' Tungstic and picric acids appear better fitted for experiments in which it is desired to precipitate the intermediate products as completely as possible." Metaphosphoric acid, colloidal iron, and mercuric chlorid gave results intermediate between trichloroacetic acid and tungstic acid.

With blood all the precipitants used appeared to remove the proteins completely. All of the precipitants except alcohol permitted similar amounts of amino nitrogen to pass into the filtrates. With alcohol about 30 per cent of the free amino acids present were apparently adsorbed by the coagulated proteins. Blood differed from peptone in that no appreciable amounts of intermediate products, precipitated by picric and tungstic acids but not by 5 or 10 per cent trichloroacetic or metaphosphoric acid, were present.

The determination of total nitrogen in nitrite-containing fertilizers and of nitrite nitrogen in the presence of nitrates, F. MACH and F. SINDLINGER

(*Ztschr. Angew. Chem.*, **35** (1922), No. 69, pp. 473, 474).--For the determination of total nitrogen in nitrites or nitrite-containing nitrates, the following method is recommended:

Thirty cc. of a saturated solution of potassium permanganate is heated to boiling with 5 cc. of 1:2 sulphuric acid, and 25 cc. of nitrite solution is added cautiously from a pipette. The solution should be of such a strength as to contain not more than 50 mg. of nitrite nitrogen. An additional 10 cc. of the sulphuric acid is then added and after cooling, about 10 gm. of iron. The mixture is heated with a low flame so that about 5 minutes is required to bring it to boiling, and is then boiled gently for another 5 minutes. Data are given showing that this method gives accurate results even in the presence of soluble chlorids and phosphates.

For determining nitrite nitrogen in the presence of nitrates, the total nitrogen is determined by the above method. Twenty-five cc. of the solution is neutralized, if necessary, with phenolphthalein as indicator, and is then mixed with 30 cc. of $\text{N}/3$ sulphuric acid and 10 cc. of neutral methyl alcohol, heated strongly for 10 minutes, and titrated after cooling with $\text{N}/3$ NaOH. To the remaining solution 5 gm. of iron and 10 cc. of sulphuric acid are added. This is heated with a low flame for 10 minutes, and then distilled in the customary manner with sodium hydroxid after cooling and diluting. If the solution contains ammonia, an aliquot must be used for this determination by distillation with sodium hydroxid. The content of nitrite nitrogen is calculated by subtracting from the total nitrogen the results thus obtained for nitrate and ammonia nitrogen.

An improved method for the determination of humus by oxidation with chromic acid, A. GEHRING (*Ztschr. Analyt. Chem.*, **61** (1922), No. 7, pp. 273-278, fig. 1; *abs. in Chem. Abs.*, **16** (1922), No. 17, p. 2948).--In the method described, from 1 to 10 gm. of soil is placed in a distilling flask with 20 cc. of water and 30 cc. of concentrated sulphuric acid, and a stream of carbon dioxide-free air is led through the closed apparatus until the carbon dioxide of the soil is completely removed. The flask is then connected with a potash absorption apparatus through a combustion tube containing copper oxide and lead chromate, 8 gm. of potassium dichromate is added to the flask, and the reaction mass is heated slowly to boiling and boiled for an hour while a stream of carbon dioxide-free air is conducted through the apparatus. After cooling, the potash tube is weighed and the calculations are made in the usual manner.

The estimation of lipid phosphoric acid ("lecithin") in blood by application of the Bell and Doisy method for phosphorus, F. S. RANDELS and A. KNUDSON (*Jour. Biol. Chem.*, **53** (1922), No. 1, pp. 53-59).--The method described combines Bloor's procedure for preparing and evaporating the alcohol-ether blood extract (*E. S. R.*, **40**, p. 16) and the Bell and Doisy method of digestion and color development (*E. S. R.*, **44**, p. 613).

In developing the technique for the determination, it was found that variations in the acidity of the digestion mixture caused variations in the color intensity, and that the presence of bubbles, probably of carbon dioxide, in the solution when first poured into the colorimeter had the effect of weakening the intensity of the color. To obviate the first source of error, it is recommended that the number of drops of sulphuric acid in the tube after digestion be kept within 6 or 8, and that the same amount be added to the standard. The second source of error can be avoided either by refilling the cup containing the standard solution each time that the unknown is changed, or, if time permits, by allowing 5 minutes for the fresh solution to settle before making the comparison.

A modification of the Bell-Doisy phosphate method, A. P. BRIGGS (*Jour. Biol. Chem.*, 53 (1922), No. 1, pp. 13-16).—This modification of the Bell-Doisy phosphate method (E. S. R., 44, p. 613) consists in the use, during the trichloroacetic acid precipitation, of a slightly different technique, which is said to prevent the resulting filtrate from being turbid and thus to permit the use of the more stable green color of the acid solution for comparison instead of the unstable blue color. By the addition of a little sodium sulphite to the acid solution containing the phosphate and molybdate, the subsequent addition of hydroquinone causes the formation of a blue instead of a green color and of a much greater intensity. The technique of the modified method is described in detail.

The qualitative detection of lactic acid, L. HARTWIG and R. SAAR (*Chem. Ztg.*, 45 (1921), No. 40, p. 322).—Attention is called to the impracticability of using the Denigès test for lactic acid (E. S. R., 22, p. 212) in solutions in which the probable content of lactic acid is unknown, a negative result in such a case signifying either the absence of the acid or the presence of too large quantities, and also of using the test with colored solutions. For determinations of lactic acid in baking powder a method described by Spaeth¹ is recommended. This consists in dissolving about 3 gm. of the baking powder in as small an amount of water as possible, adding a drop of methyl orange, and running in from a burette sufficient phosphoric acid to form a permanent red precipitate. The solution is then mixed with sand and plaster of Paris and allowed to stand for several hours until the mass hardens. It is then pulverized and extracted with ether in a Soxhlet apparatus. On filtering and evaporating the ether extract to dryness a sticky sirupy mass is left in the presence of lactic acid. This can be diluted to 0.2 per cent solution and tested for lactic acid in the usual way.

A note on the determination of uric acid, H. JACKSON, JR., and W. W. PALMER (*Jour. Biol. Chem.*, 53 (1922), No. 2, p. 373).—A solution which is said to give the same results in uric acid determinations as the more complicated reagent previously noted (E. S. R., 47, p. 14) is made as follows: The phosphotungstate B, prepared as described in the previous paper, is dissolved in 95 per cent alcohol in the proportion of 250 cc. of alcohol for each 100 gm. of the solid. The solution is filtered, evaporated to dryness in a water bath with frequent decolorizations with bromin water, and the dry product dissolved in a little hot water, decolorized again, and evaporated to dryness. A 20 per cent solution is then made of the purified salt, and to each 100 cc. of the solution is added 34 cc. of a 2.5 per cent water solution of primary calcium phosphate.

Detection of goat's milk in mixtures with cow's milk, W. AUSTEN (*Milchz. Zentbl.*, 50 (1921), No. 10, pp. 125-127).—The test described consists in adding 2 cc. of 25 per cent ammonium hydroxid solution to 20 cc. of the skim milk, heating the mixture in the water bath at 50 to 60° C. for $\frac{1}{2}$ hour, and then centrifuging at 1,200 r. p. m. If goat's milk is present to the extent of 20 per cent or more of the mixture a marked precipitate is said to result, while with undiluted cow's milk no precipitate is formed.

Sugar purity determinations, W. D. HORNE (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 10, pp. 944, 945, fig. 1; also in *La. Planter*, 69 (1922), No. 16, pp. 265, 266, fig. 1; *Facts About Sugar*, 15 (1922), No. 17, pp. 338, 339, fig. 1.)—For rapid determinations of sugar purity the author has devised a specially constructed Brix spindle in which the temperature corrections can be read directly. The spindle is about 30 cm. in length with a stem 15 cm. long on which is engraved a 11-cm. scale covering 8 full degrees divided into tenths. The lower

¹ Pharm. Zentralhalle, 60 (1919), Nos. 48, pp. 557-567; 49, pp. 559-563; 51, pp. 597-604; 61 (1920), Nos. 2, pp. 13-17; 5, pp. 51-56

part of the spindle is almost conical in shape. Immediately adjacent to the mercury column are two direct temperature correction scales, the scale on one side representing the temperature corrections applicable for density at the top, and on the other side at the bottom of the Brix scale. The temperature readings are marked on one side and cover a range in Centigrade degrees of from 10 to 35°, with 20° as the normal temperature. In practice the Brix is made up arbitrarily to lie quite near one end of the scale, an 8 to 16 Brix spindle being used for dark solutions and a 16 to 24 spindle for lighter colored solutions.

After the density of the solution has been determined, the clarification for polarization is made with specially prepared anhydrous lead subacetate in place of the basic lead acetate solution usually employed. The dry powder produces no alteration in the density of the solution and thus shortens the process materially. The polarization is conducted in the usual way, using the intermittent tube when the solutions are of varying densities. A convenient arrangement is described for calculating the results from a table of figures giving all the purities corresponding to the different tenths of a degree Brix between any two consecutive degrees and the different tenths of a degree by the polariscope.

The deterioration of white sugar during storage in Mauritius. H. A. TEMPANY and D. D'E. DE CHARMOY (*Mauritius Dept. Agr., Gen. Ser., Bul. 24 (1922), Eng. ed., pp. 25, pls. 2*).—This publication consists of the report of an investigation of the causes of the deterioration of cane sugar in Mauritius. The principal cause of the deterioration is considered to be the absorption of moisture from the atmosphere, which in turn leads to the destruction of the sucrose by the action of bacteria and molds. The organisms found in deteriorated sugars consisted of molds and bacteria, the main destructive agent apparently being a form of torulae differing somewhat from those described by other investigators of sugar deterioration.

The question of minimizing losses of sugar due to this deterioration is thought to consist essentially in protecting the sugar so far as possible from conditions leading to moisture absorption. It is recommended that warehouses for the storage of sugar be provided with doors and windows capable of being tightly closed to avoid currents of moist air, and with floors of nonconducting material. The use of crinkly paper linings for sugar bags is recommended for protecting the sugar from direct contact with the air.

Extraction of copra cake with solvents. A. P. WEST and J. M. FELICIANO (*Philippine Jour. Sci., 20 (1922), No. 5, pp. 509-517*).—A brief account is given of copra and coconut oil production in the Philippines, and the results are reported of a comparative study of the value of different solvents for extracting the residual oil in copra cake. Both expeller and hydraulic copra cake were used with a number of organic solvents. The Soxhlet extraction apparatus was used in all cases, the intensity of the heat being regulated by the use of asbestos pads so that the length of time required for siphoning over was the same in all cases. The extraction was continued with equal weight samples for varying periods of from 3 to 36 hours, after which the extracted oil was weighed.

Ether, carbon tetrachlorid, and benzene gave approximately the same percentage extraction. Chloroform, acetone, and petroleum ether appeared to dissolve not only the oil but also small quantities of nonfatty substances from the expeller copra cake, and ethyl and methyl alcohols a considerable quantity. Carbon tetrachlorid or benzene is considered to be the most suitable solvent for the routine estimation of the residual oil.

By extracting expeller copra cake with carbon tetrachlorid and then extracting the oil-free cake with methyl alcohol, a nonfatty substance was obtained which had a high acid and saponification value and contained a small percentage of nitrogen.

METEOROLOGY.

Influence of varying soil conditions on night-air temperatures, E. H. HAINES (*U. S. Mo. Weather Rev.*, 50 (1922), No. 7, pp. 363-366).—In this article a relation is shown "to exist between the temperature of the soil and the ensuing minimum temperature of the air immediately above, as affected by the varying conditions of the former—constituent character of the soil, moisture content, and the amount and character of the vegetal cover."

It is pointed out that "low night-air temperatures in gardens and truck farms may often be prevented in the first place by the selection of soil in which there is a sandy component, as sand and sandy loams are warmer than other soils and give off heat in the nighttime by conduction to the air above, thus diminishing the probability of critical temperatures and the formation of damaging frosts. Secondly, the land in use should be well drained of surplus moisture, as wet soils are invariably cold soils and more susceptible to frost damage. Lastly, any soil whether it be sand, loam, or clay, is warmer when it is clean and free from weeds and unnecessary vegetation, as bare soils are productive of higher night-air temperatures than those covered with a rank growth, from which the heat received in the daytime is lost at night by radiation to space.

"Finally, there may be several reasons why frost forms on one side of a street and not on the other, or in one section of a level farm and not in another. If there are contrasting soils, one producing relatively high night-air minima and the other relatively low readings, or if the land differs even slightly in the amount of moisture, or in the kind and extent of the surface covering, or amount of insolation received, frost will appear in the sections which have wet, cold soils covered with heavy vegetation or uncultivated, while, on the same night and under the same meteorological conditions, frost may not form on other ground close by where the soil is relatively dry, warm, and clean."

Predicting minimum temperatures in the vicinity of Walla Walla, Wash., C. C. GARRETT (*U. S. Mo. Weather Rev.*, 50 (1922), No. 7, pp. 366-368). It is stated that "beginning with the spring frost season of 1915, a localized frost-warning service has been maintained at the Weather Bureau office at Walla Walla, Wash., for the benefit of orchardists and truck gardeners in various districts of southeastern Washington and northeastern Oregon." Four different methods were used in securing data for predictions. The average of the minimum temperatures indicated by these methods, as well as the observed local conditions and the general barometric and weather conditions, as shown by the evening weather charts, were used. The results for a number of typical radiation nights indicate a high degree of reliability for the predictions.

Influence of cover crops on orchard temperatures, F. D. YOUNG (*Calif Citrogr.*, 8 (1922), No. 1, pp. 5, 18-20, figs. 3).—Observations with sheltered thermometers, 10 in. above ground, at the Citrus Experiment Station at Riverside, Calif., are reported. These observations did not indicate any great difference in temperature between the cultivated and cover-crop areas.

Relation of sunlight to plant development, G. D. HEARN (*U. S. Mo. Weather Rev.*, 50 (1922), No. 8, pp. 423, 424).—This article is based largely on an article by Garner and Allard, previously noted (*E. S. R.*, 42, p. 818).

Summarizing the conclusions from this work, the author states that "seed reproduction can be attained by the plant only when it is exposed to a specifically favorable length of day (the requirements in this particular varying widely with the species and variety), and exposure to a length of day unfavorable to reproduction but favorable to growth tends to produce gigantism or indefinite continuation of vegetative development, while exposure to a length

of day favorable alike to seed reproduction and to vegetative development, extends the period of seed reproduction and tends to induce the 'everbearing' type of fruiting. The term photo-period is suggested to designate the favorable length of day for each organism."

Forecasting seasonal rainfall from ocean temperatures, G. F. McEWEN (*Bul. Amer. Met. Soc.*, 3 (1922), No. 10, pp. 135-137).—A forecast for southern California for the season of 1922-23, based on six years' observations on temperature at six stations in the coastal area of that region, is given. The hypothesis on which the forecast rests is that rainfall in this region depends mainly upon the eastward flow of water-laden air from the Pacific Ocean, and that the thermal effect due to the difference in the action of radiation and evaporation on land as contrasted with water surfaces is an important factor in the precipitation of this water. A correlation between temperature and rainfall is clearly indicated by recorded observations in the region.

An eight-year cycle in rainfall, H. L. MOORE (*U. S. Mo. Weather Rev.*, 50 (1922), No. 7, p. 357, fig. 1).—A curve plotted from the smoothed departures of rainfall in the United States, compared with a graph of an 8-year cycle derived from the smoothed departures by the method of least squares, shows substantial agreement between the two and indicates maxima of rainfall at about 1882, 1890, 1898, 1906, and probably 1922.

Reference is made to a previous article by the author¹ showing that "8-year cycles with approximately these same dates for maxima occur in the rainfall of the Ohio Valley, the rainfall of Illinois, the May and June rainfall of the Dakotas, the barometric pressure in the United States, the winter barometric pressure in Central Europe, the yield of crops in the United States, the yield of crops in the United Kingdom, the yield of crops in France, and the index number of wholesale prices throughout a century."

Rainfall in Kent, England, and Pas-de-Calais, France, E. MATHIAS (*Ann. Phys. [Paris]*, 9, ser. 16 (1921), Nov.-Dec., pp. 305-310; *abs. in Sci. Abs.*, Sect. 4—Phys., 25 (1922), No. 292, p. 273).—In an article previously noted (*E. S. R.*, 41, p. 419), the author found the relation between mean annual rainfall h and altitude A to be, for moderate altitudes in France, $h=h_0+kA$, the coefficient k being a function of latitude. The study reported in this article shows "that the same values of the constants are found by applying the method to data for southeast England as for northeast France (Pas-de-Calais, Somme, and Ardennes), the actual formulae obtained being respectively $h=657.8+1.2A$ and $h=657.1+1.2A$, where h is in millimeters and A in meters."

Nitrogen and other compounds in rain and snow, J. E. TRIESCHMANN and N. KNIGHT (*Iowa Acad. Sci. Proc.*, 27 (1920), pp. 159-164).—The observations recorded in this article have been noted from another source (*E. S. R.*, 41, p. 620).

Monthly Weather Review (*U. S. Mo. Weather Rev.*, 50 (1922), Nos. 7, pp. 341-391, pls. 10, figs. 14; 8, pp. 393-451, pls. 9, figs. 15).—In addition to detailed summaries of meteorological, climatological, and seismological data and weather conditions for July and August, 1922, and bibliographical information, reprints, reviews, abstracts, and minor notes, these numbers contain the following contributions:

No. 7.—The Semipermanent Arizona Low (illus.), by E. A. Beals; The Pressure Distribution at Various Levels During the Passage of a Cyclone Across the Plateau Region of the United States (illus.), by C. L. Melsinger; An Eight-year Cycle in Rainfall (illus.), by H. L. Moore (see above); Brooks and Glasspoole on the Drought of 1921 (illus.), by A. J. Henry; Brief Description of a New

¹ *Quart. Jour. Econ.*, 36 (1921), No. 1, pp. 1-29, figs. 10.

Dial for the Aneroid (illus.), by J. C. Millás; Thunderstorms of July 13, 1922, in the District of Columbia, Maryland, and Virginia (illus.), by A. J. Henry; Tornadoes in South Dakota, July 8, 1922, by M. E. Blystone; Influence of Varying Soil Conditions on Night-air Temperatures, by E. H. Haines (see p. 113); Predicting Minimum Temperatures in the Vicinity of Walla Walla, Wash., by C. C. Garrett (see p. 113); and The Temperature at Porto Velho, Amazonas, Brazil, by A. J. Henry.

No. 8.—The Earth's Atmosphere as a Circular Vortex (illus.), by A. L. Beck; J. Bjerknes and H. Solberg on Meteorological Conditions for the Formation of Rain (illus.), by A. J. Henry; Precipitation in Oregon (illus.), by E. L. Wells; The Rainfall of Brazil (illus.), by A. J. Henry; The Etesians (illus.), by J. S. Paraskévopoulos; Relation of Sunlight to Plant Development, by G. D. Hearn (see p. 113); Temperature of Air in the Ice Cavern of Dobsina, by D. L. Steiner; Severe Hailstorm Near West Chester, Pa.; The Charlottesville, Va., Tornado of August 7, 1922, by A. W. Giles; and Tornadoes in New Mexico.

Meteorological summaries (*Kentucky Sta. Rpt. 1921, pt. 1, pp. 51-53*) -- Tables compiled from the records of the U. S. Weather Bureau Station at Lexington, Ky., summarize data for temperature, precipitation, humidity, wind, and cloudiness, 1872-1921.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. OSTRANDER and G. E. LINDSKOG (*Massachusetts Sta. Met. Buls. 405-406 (1922), pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during September and October, 1922, are presented. The data are briefly discussed in general notes on the weather of each month.

SOILS—FERTILIZERS.

The physico-chemical problems relating to the soil—a general survey, H. J. RUSSELL (*Faraday Soc. Trans., 17 (1922), No. 2, pp. 219-223*).—A brief general survey of the problems relating to the mineralogy, organic matter content, colloidal properties, and solutions of the soil is presented.

The physical properties of the soil in relation to survey work, G. W. ROBINSON (*Faraday Soc. Trans., 17 (1922), No. 2, pp. 224-227*).—It is claimed that the classification of soils on the basis of mechanical analysis is of use mainly from the genetic standpoint, and that the information given by such analysis is of comparatively little value in characterizing the actual properties of the soil other than that they are classified simply into sands, loams, and clays. The opinion is expressed that an edaphic classification should be based upon actual soil properties, and that for this purpose the soil might better be characterized by a series of physical constants comparable to those used in the description of a newly discovered element or compound.

Soil types as a basis for soil investigations, P. E. BROWN (*Jour. Amer. Soc. Agron., 14 (1922), No. 5, pp. 198-206*).—This paper is based on the results of studies conducted mainly at the Iowa Experiment Station. It is emphasized that scientific work on soils can not be intelligently conducted without a knowledge of the soil type, and that if conclusions are not based upon the specific soil conditions they are absolutely worthless. "If we are to have a real soil science, a science which will rank with other sciences, pure or applied, we must get on a scientific and sound basis, and we can do this only by basing our experiments, field, greenhouse, chemical, and bacteriological, on a soil foundation, or in other words, on soil type separations."

Soil survey of Flagler County, Fla., A. E. TAYLOR (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 41, fig. 1, map 1*).—This survey deals

with the soils of an area of 314,240 acres in northeastern Florida. It is separated into two main topographic divisions, the low-ridge region along the coast and the flat-woods proper comprising the remainder of the area. The surface in general is almost level, broken along the coast and to a lesser degree along streams and around lakes by low ridges. Comparatively small areas of the county are said to be well drained. The remainder of the county, with the exception of small, scattered, low, ridgy areas of from 10 to 100 acres, is poorly drained, and there are large areas in which drainage is either lacking or only partially established.

The soils of the county vary from loose sands to heavy clays and peaty muck, but they are predominantly fine sands. They range from shallow, undrained soils of basin areas through flat, poorly drained areas to excessively drained ridges. On the basis of origin they are classed as soils derived from sedimentary formations, alluvial soils, cumuloze soils, and unclassified soils. Including swamp, peaty muck, tidal marsh, marsh, and coastal beach, 19 soil types of 11 series are mapped, of which the Bladen fine sand, St. Johns fine sand, Bladen fine sandy loam, and Leon fine sand cover 24.7, 23.1, 14.7, and 13.1 per cent of the area, respectively.

Reconnaissance soil survey of northwest Texas, W. T. CARTER, JR., ET AL (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. IV+75, pls. 14, fig. 1, map 1*).—This survey, made in cooperation with the Texas Experiment Station, deals with the soils of an area of 12,418,560 acres, including 22 counties in the northwestern part of Texas lying within the semiarid region of the Great Plains. The area consists in the western part of high, nearly level plains and in the eastern part of lower rolling plains, between which major divisions there is a belt of rough, broken country forming an escarpment. There is said to be very little run-off in the High Plains owing to the nearly level surface. Most of the rain water is absorbed at once by the soil or collects in the slight depressions. The more numerous streams crossing the eroded or low plains with their tributaries give adequate drainage to all parts of the eastern section of the area. Owing to the porous nature of the various sandy soils, the rain water is absorbed to a large degree and few or no stream channels have been formed.

The soils of the area are derived from Permian formations and from Tertiary and Quaternary deposits. Small areas of recent alluvial and wind blown soils are also found. Including rough broken land, rough stony land, and undifferentiated alluvial soils, 26 soil types of 9 series are mapped, of which the Amarillo fine sandy loam and clay loam cover 20.4 and 18.9 per cent of the area respectively. Rainfall is said to be the limiting factor in the productivity of the soils of the area. Some land in the High Plains is irrigated with water pumped from wells, and in the lower-plains section there is an irrigation project drawing its water supply from a reservoir.

[Soils work at the Kentucky Station] (*Kentucky Sta. Rpt. 1921, pt. 1, pp. 32-36*).—The work on soil experimental fields in Kentucky, including so-called outlying soil experimental fields, is briefly described, in continuation of similar work previously noted (*E. S. R., 44, p. 510*). It is noted that on the Lexington soil field the results continue to show that the requirements of the soils are the maintenance of nitrogen and organic matter. Results on the outlying experimental fields are said to continue generally in harmony with results previously reported.

Laboratory and greenhouse studies on the behavior of limestone and acid phosphate and rock phosphate in relation to soil reaction have shown that generally on unlimed soil rock phosphate is as effective as acid phosphate, while on limed soil very wide variations occur in their relative effectiveness.

A study of sulphur in plants and soils and its significance to permanent soil fertility has shown distinct benefit in yields from the so-called basic phosphate, prepared at the New Jersey Stations, which is a mixture of ground rock phosphate with sulphur inoculated with sulphur-oxidizing bacteria.

The formation of pans in soil, C. G. T. MORISON (*Faraday Soc. Trans.*, 17 (1922), No. 2, pp. 321-324).—A brief study of the formation of pans in soil is presented, from which it is concluded that the separation of removable material into a definite layer as in pan formation is an exceptional feature, but that the removal of these materials and more essential plant food substances such as phosphorus and potassium is always associated more or less with the existence of an acid humus layer. It is pointed out that in this connection a more precise knowledge of the physical and chemical changes involved should benefit agricultural practice.

On clays as disperse systems, S. ODFÉN (*Faraday Soc. Trans.*, 17 (1922), No. 2, pp. 327-348, figs. 18).—The author defines clay as a disperse formation of mineral fragments in which particles of dimensions smaller than $2\ \mu$ predominate, and proceeds to study different clays on this basis. Special attention is paid to the characterization of clays by means of distribution curves. It is pointed out that a soil layer is a clay, a silt, or a sand soil according to whether the greatest part falls within the limits for clay, loam, or sand. The properties of firmness, plasticity, permeability, etc., are not entirely dependent upon the preponderant constituent and its fineness but also upon substances occurring to a smaller extent, and are, therefore, greatly dependent upon the nature and character of the distribution curve. It is pointed out that distribution curves characterize the loose soils far better than mechanical soil analysis. These curves are determined by levigating a clay in water and then studying the rate of sedimentation. This was accomplished by suspending a fine plate from a balance beam immediately over the bottom of a sedimentation vessel and from time to time determining the weight of the deposited particles. The rate of accumulation of these particles is dependent at every moment both on the number of the particles and their weight and distribution. The use of this method in a study of layers of Swedish stratified clay is described.

Note on the hygroscopicity of clay and the quantity of water adsorbed per surface unit, S. ODFÉN (*Faraday Soc. Trans.*, 17 (1922), No. 2, pp. 244-248, figs. 4).—Studies are reported with clay soils in which vapor pressure measurements were taken in a large desiccator containing the clay and a sulphuric acid water mixture. It was found that the coarser the clays the less water was held, while the stiff, strongly plastic clays retained larger quantities of water. Further studies and a mathematical analysis led to the conclusion that calculation backwards from hygroscopicity to surface development of a soil is fallacious, the hygroscopicity being obviously dependent not only on the surface development but also on the chemical nature and constitution of the clay.

The phenomena of absorption in soils: A critical discussion of the hypotheses put forward, E. A. FISHER (*Faraday Soc. Trans.*, 17 (1922), No. 2, pp. 305-316, figs. 2).—This is a critical summary of different theories on the phenomena of absorption in soils which indicates that the author is not entirely satisfied that the present knowledge of the subject is adequate.

The mechanism of flocculation in soils, N. M. COMBER (*Faraday Soc. Trans.*, 17 (1922), No. 2, pp. 349-353).—Observations regarding the flocculation process in soils as it is brought about by electrolytes in general and by lime in particular are reported.

It was found that clay is readily flocculated by lime, while fine silt is not. The flocculation of soil particles appeared, therefore, to fall fairly well into line with the flocculation of suspensoid sols and, with the flocculation of these

sols, to be amenable to the isoelectric point theory. As an exception, the flocculation of clay by lime did not appear to be compatible with the electric theory, since the hydroxyl ion tended to stabilize the suspension.

In a study of clay flocculation in general and of the abnormal effect of alkalinity thereon, three cases of flocculating action are recognized which include direct flocculation, indirect flocculation, and abnormal flocculation. Abnormal flocculation, in which the flocculant reacts with the protecting emulsoid matter forming a coagulum which entrains the particles, is considered to be of the greatest agricultural importance, as it appears to provide a feasible explanation of the abnormal flocculation of clay by lime.

"While, then, the mechanism of flocculation in soils does not generally appear to be essentially different from that of the flocculation of suspensoid sols, the flocculation of clay by lime is a process of a distinctly different type. Using the prevalent terminology, it is an 'emulsoid' phenomenon and is quite out of line with the flocculation of 'suspensoids.'"

The system soil-soil moisture, B. A. KERN (*Faraday Soc. Trans.*, 17 (1922), No. 2, pp. 228-243, figs. 4).—This is a comprehensive review of work by the author and others bearing on the subject.

It is shown that the colloidal material in the soil exercises a profound effect on the moisture relations, and that these relations are continuous over a wide range of moisture content. It is concluded that further progress in our knowledge of the moisture relations in soil is most likely to follow if its colloidal properties are taken into account.

The influence of irrigation water on the composition of the soil, J. E. GREAVES (*Jour. Amer. Soc. Agron.*, 14 (1922), No. 5, pp. 207-212).—This paper summarizes briefly some results which have been obtained on the subject at the Utah Experiment Station during the past 10 years. Hundreds of samples of water representing 58 streams, the majority of which are extensively used for irrigation purposes, have been analyzed. These have shown that 2 acre-feet of water have carried to the soil from 44 to 266.6 lbs. of potassium, the latter being sufficient to produce 370 bu. of corn, 230 bu. of wheat, or 34 tons of sugar beets.

The total phosphorus content of the irrigation waters analyzed varied from traces to 5.47 parts per million, although the great majority contained less than 1 part per million. The average in 2 acre-feet from the streams was 3.46 lbs., from wells 3.36 lbs., and from drains 1.82 lbs. Two acre-feet of the water from the richest stream are said to be sufficient in phosphorus content for the production of 175 bu. of corn, 120 bu. of wheat, or 33 tons of sugar beets.

The average quantity of nitrogen in 2 acre-feet of the irrigation water was found to be 22.8 lbs., while that in the richest water was 132.2 lbs., which is considered to be sufficient to produce 186 bu. of corn, 114 bu. of wheat, or 17 tons of sugar beets.

In addition to its fertilizer constituents, the irrigation water was found to carry varying quantities of soluble salts which may at times be sufficiently concentrated to become a menace.

It is concluded that the intelligent use of irrigation water requires a knowledge of the chemical, physical, and biological properties of the soil, together with a knowledge of the composition of the water and its influence upon the different changes in the soil.

Soil acidity in its physico-chemical aspects, E. M. CROWTHER (*Faraday Soc. Trans.*, 17 (1922), No. 2, pp. 317-320).—The author discusses the measurement of the H-ion concentration of soils, the action of neutral salts on acid soils, and the relation of soil acidity to plant growth as methods of studying the soil reaction.

The vertical distribution of soil acidity in natural soils and its relation to the organic constituents, E. J. SALISBURY (*Faraday Soc. Trans.*, 17 (1922), No. 2, pp. 295-298).—A brief summary of a large number of studies is presented, indicating that acidity decreases from the top soil downward. The only exceptions to this are where the subsoil is highly basic and the humus is particularly rich in salts and decaying rapidly, where there is flush vegetation, or where there are corresponding irregularities in the humus gradient.

The application of physico-chemical methods to the study of humus, S. ODÉN (*Faraday Soc. Trans.*, 17 (1922), No. 2, pp. 288-294, figs. 3).—This paper deals with studies of the acid or nonacid nature of certain substances occurring in humus. The opinion is expressed that the usefulness of the liming of peaty soil depends on the formation of a rich supply of lime humates. A mixture of humic acid and its lime salts is considered to make an excellent regulator which prevents both a strong acid reaction and an alkaline reaction.

Further studies led to the conclusion that it is hardly probable that bog flora owe their xerophytic habits to want of water.

The part played by organic matter in the soil system, H. J. PAGE (*Faraday Soc. Trans.*, 17 (1922), No. 2, pp. 272-287, fig. 1).—In a contribution from the Rothamsted Experimental Station an outline is presented of the general physico-chemical aspects of the relation of the organic matter of the soil to soil fertility.

It is concluded that "the general effect of humus colloid on a mineral soil may perhaps best be summed up as that of a 'buffer' substance, using the word in its widest sense. Its effects on the tilth, on soil moisture, soil temperature, and soil solution are all such as to avoid harmful extremes, and to bring the properties of the most divergently composed mineral soils nearer to that happy mean which the agriculturist desires and which tends to give the most stable and uniform cropping results under very variable climatic and weather conditions."

Microbiological analysis of soil as an index of soil fertility.—1. The mathematical interpretation of numbers of microorganisms in the soil, S. A. WAKSMAN (*Soil Sci.*, 14 (1922), No. 1, pp. 81-101).—Studies conducted at the New Jersey Experiment Stations on the mathematical interpretation of numbers of microorganisms in the soil are reported.

It was found that the variability of the common method employed for quantitative determination of microorganisms in the soil is too high when only from two to three plates are used, and too much reliability can not be attached to the results. It is thought that only by the use of a large number of plates and by making an accurate determination of the probable error involved can it be stated definitely how much weight can be attached to the results obtained from a quantitative examination of the microorganisms in soils.

The dilution commonly employed for counting bacteria and Actinomycetes is considered to be too high for the counting of fungi, so that the results obtained from counting fungi on the same plate with the bacteria and Actinomycetes are worthless for most soils. Special acid media, whereby only fungi will develop, combined with a low dilution were found to give more reliable results. The variability of the soil samples taken from the field is too high to enable the attaching of great importance to determinations based upon a single sample.

A number of samples should be taken from each field, these to be composited into fewer samples which should be used for the bacteriological studies. It is thought that even then the probable error should be determined. By combining a relatively large number of plates with a large number of soil samples, the probable error involved in a quantitative determination of the microorganisms in the soil can be worked out. A set of figures for the designation of the

relative importance to be attached to the determinations, based upon the number of plates and soil samples, is suggested.

Azotobacter in soils, P. L. GAINES (*Science*, 56 (1922), No. 1436, p. 21).—Pursuant to a previous contribution from the Kansas Experiment Station (E. S. R., 44, p. 213), cultural studies with *Azotobacter* and absolute reaction determinations of 418 samples of soil collected from 39 counties in Kansas and from 25 other States are briefly reported. These soils have been arbitrarily divided into two groups, those the H-ion concentration of which was found to be greater than 1×10^{-6} , and those with a lower H-ion concentration. This division point was chosen because a large amount of data accumulated indicated that the maximum H-ion concentration tolerated by *Azotobacter* is very near that point. It was demonstrated that when *Azotobacter* are introduced into a soil with a H-ion concentration greater than 1×10^{-6} , and not containing *Azotobacter*, they can exist therein for an appreciable length of time. It is believed that these data are significant in indicating the influence of the H-ion concentration of a soil upon the ability of that soil to support *Azotobacter*.

Effect of green manure at different stages of growth upon the relative abundance of Actinomyces, nonspore formers, and spore formers in the soil, T. L. MARTIN (*Utah Acad. Sci. Trans.*, 2 (1918-1921), pp. 245, 246).—This is an abstract of a contribution from the Brigham Young University, in which the results of experiments are presented, showing that the addition of manure to clay loam soil resulted in an increase in the number of organisms. The three groups in question were not affected to the same extent. The Actinomyces group was affected the most and the spore formers the least. The fresher the manure added, the greater were the numbers of Actinomyces and nonspore-formers. These results, together with the results obtained by previous investigators, suggest the idea that Actinomyces are probably associated with the decomposition of organic matter.

Nitrogen in relation to crop production in the Middle West, S. D. CONNER (*Jour. Amer. Soc. Agron.*, 14 (1922), No. 5, pp. 179-182).—Studies conducted at the Indiana Experiment Station are summarized, the results of which are taken to indicate that, except on those soils which still have a large portion of unexhausted nitrogen, the nitrogen problem is the most important soil fertility problem in the corn belt. Average Indiana soils are said to have lost approximately 20 lbs. of nitrogen per acre per year for the last half century, and this loss is continuing.

The importance of the use of legumes and manure and in some cases the supplemental use of nitrogen fertilizers is emphasized. Much of the profit in the use of lime, phosphate, and potash is considered to be in the beneficial effect upon legumes. Thus, these materials act indirectly as nitrogenous fertilizers.

The Muscle Shoals plant and the nitrogen supply, J. K. CLEMENT (*Mech. Engin.* [New York], 44 (1922), No. 6, pp. 357-359, figs. 3).—This is a résumé of the development of the nitrate industry in the United States and a discussion of its present requirements. The essential uses of nitrogen in this country are outlined, with special reference to fertilizers, and the four forms in which nitrogen was obtainable before fixation from the atmosphere was developed are briefly discussed, including proteins, ammonia, nitrates, and cyanids. Fixation of atmospheric nitrogen by the arc, Haber, and cyanamid processes is discussed, and the Government Nitrate Plant No. 2 is described, with particular reference to power and raw material requirements and the convenience with which these requirements can be supplied. The various chemical processes are explained in some detail, and charts and tabular data giving information on the nitrogen situation in this country and abroad are presented and discussed.

A contribution to the chemistry of alunite, H. BOWLEY (*Roy. Soc. West. Aust. Jour. and Proc.*, 7 (1920-21), pp. 48-68, fig. 1).—The results of a study of the chemical properties of alunite, made as part of an investigation into the value of potash-bearing minerals of Western Australia, are reported.

It was found that alunite is not affected by dry heat at temperatures up to 300° C. The decomposition of the mineral in alum roasting is in two stages. At 400° it loses 4.5 M of water with the formation of a basic sulphate of aluminum and potash, and on further heating to a temperature of 500° the remaining water is removed, forming an anhydrous basic sulphate. On the addition of water the basic sulphates dissociate, producing a true alum and precipitating aluminum hydrate.

Alunite heated to a temperature of 800° dissociates completely into potassium sulphate, alumina, sulphur trioxid, and water. Part of the sulphur trioxid dissociates further into a mixture of sulphur dioxide and oxygen. On heating alunite to a temperature of 960°, the potassium sulphate formed is dissociated and interacts with the alumina to form soluble potassium aluminate, or, in the presence of silica, insoluble potassium aluminosilicates.

Alunite was found to be readily soluble in warm dilute solutions of caustic alkali, hydrofluoric acid, and hot, strong sulphuric acid, slowly soluble in cold solutions of sodium carbonate, moderately soluble in hydrochloric acid and warm dilute sulphuric acid, and sparingly soluble in water. It was found to be readily soluble in warm solutions of sodium carbonate and fairly so in a solution of caustic lime, the whole of the potash passing into solution. It was appreciably attacked by calcium carbonate solutions.

Studies with Rhenania phosphate, T. REMY and F. WEISKE (*Lundw. Jahrb.*, 56 (1921), No. 1, pp. 1-57, figs. 2).—Pot and plat experiments with several crops and soils to determine the relative value of Rhenania phosphate as a phosphoric acid fertilizer are reported.

It was found that in 9 out of 15 cases the citrate-soluble phosphoric acid of Rhenania phosphate accomplished more than that of Thomas phosphate, while in 6 cases they seemed to be of about equal value. The fertilizing action of Rhenania phosphate corresponded to its citrate solubility in about 40 per cent of all cases, and exceeded it in about 60 per cent. The action varied widely between good and poor samples. In general, the Rhenania phosphate was more available in strongly alkaline soils or where bush beans were grown as a crop. The total phosphoric acid of Rhenania and Thomas phosphates seemed in 3 cases to give about equal results, while in 4 cases that of Rhenania phosphate proved the better.

Studies on the relative value of Rhenania phosphate as a potash fertilizer showed that the utilization of its potash content by different crops varied from 47 to 100 per cent, averaging 73 per cent of the corresponding potassium chlorid value. About the same relation was found as regards increase in yields. In 4 cases the potash of Rhenania phosphate gave increases in crop yields, averaging 81 per cent of those given by potassium sulphate. In other cases the yield increases were not so good, and everything indicates a tendency in manufacture to increase the amount and availability of the phosphoric acid in Rhenania phosphate rather than that of the potash.

Studies of the conditions of solubility and their relation to the fertilizing value of Rhenania phosphate are also reported, confirming the above results.

Interim report of the basic slag committee ([London]: *Min. Agr. and Fisheries*, 1921, pp. 15; *ads. in Jour. Min. Agr.* [London], 28 (1921), No. 6, pp. 521-525).—This report deals with the possibility of increasing the amount

or quality of basic slag by various modifications of the steel-making process and with the agricultural value of the slags now obtainable. Tabular data are appended on the production and disposal of basic slag in Great Britain in 1919 and 1920, production of basic steel and basic slag by districts in 1919 and 1920, imports and exports of basic slags from 1908 to 1920, deliveries of basic slag in each county of England and Wales during 1916 and 1917 and in the whole of England and Wales during 1919 and 1920, and acreage under crops and grass in 1917 and 1920. The results of preliminary experiments on the enrichment of basic slag by the addition of natural rock phosphate and complete analyses of different basic slags are also tabulated.

The scheme of the experiments on basic slag at the Rothamsted Experimental Station is outlined. These deal with the effect of basic slag on hay and root crops and on the effect of other constituents such as manganese on the action of basic slag. A grazing experiment with sheep is also included. It was found that slags of low solubility gave the poorest results. No support was obtained for the idea that manganese is useful.

Second interim report of the permanent committee on basic slag ([London]: *Min. Agr. and Fisheries*, (1922), pp. 4; *abs. in Jour. Min. Agr. [London]*, 29 (1922), No. 6, pp. 530-533).—The report of the permanent committee on basic slag for the year 1921 gives data on the demand for and production of basic slag, basic slag importation, the possibilities of increased or improved production, and remedies for shortage.

The field trials so far indicate that the highly soluble open hearth basic slags have the same agricultural value per unit of phosphoric acid as the old Bessemer slags. The slags of low solubility have a smaller value, but under some circumstances the difference is not marked. Considerable diversity in effectiveness was indicated, however, and it is believed that the slags of low solubility include materials of a very variable nature, although the citric solubility tests failed to distinguish satisfactorily between them. The mineral phosphate also had a smaller value, but in some cases not so much as might have been expected. A solubility test with slags of different solubilities leads to the conclusion that the official solubility test needs revision.

Field experiments with rock phosphates and basic slag, I, G. S. ROBERTSON (*Jour. Min. Agr. [London]*, 29 (1922), No. 6, pp. 519-530, pls. 2, fig. 1).—Experiments extending from 1915 to 1919, inclusive, in which basic Bessemer, basic open hearth, and basic open hearth fluorspar slags were compared with Florida pebble, Tunisian, Algerian, Gafsa, and Egyptian rock phosphates and Cambridge coprolites as sources of phosphoric acid on meadow lands, are reported.

The open hearth fluorspar basic slags were not so effective as the more soluble types. They had considerable value, however, and gave better results than the solubility figures would indicate. Their effectiveness more closely approximated that of the more soluble types where the soil was sour and the rainfall high. Their inferiority was clearly marked where the soil was not decidedly sour and the rainfall low. It is concluded that for the manuring of grassland, the value of fluorspar basic slags may be considered to be from 50 to 70 per cent of that of the more soluble slags.

On sour soils and where the rainfall was high a certain amount of evidence was obtained which indicates that rock phosphates may prove superior even to the best grades of basic slag. Even under conditions of low rainfall and a nonacid soil, their value as a source of phosphoric acid for the manuring of grassland was very nearly equal to that of highly soluble basic slag. In every case they were more effective than the open hearth fluorspar slags. Of the

various types of rock phosphate tested, the Gafsa seemed to be the most suitable for direct application. Evidence was obtained that on sweet soil where the rainfall is low, the more soluble types of North African phosphates, such as the Gafsa, Egyptian, Algerian, and Tunisian phosphates are superior to the richer, less soluble, and harder types, such as the Florida pebble.

Fertilizer experiments with sulphite waste liquors, H. G. SÖDERBAUM (*Meddel. Centralanst. Försöksv. Jordbruksområdet*, No. 230, pp. 12; also in *K. Landtbr. Akad. Handl. och Tidskr.*, 61 (1922), No. 4, pp. 315-323).—Experiments with oats on a sand soil deficient in organic matter and plant nutrients to determine the fertilizing value of sulphite waste liquor from a cellulose factory in southern Sweden are reported.

The waste liquor contained about 19.4 per cent of organic matter, of which from 4 to 5 per cent was sugar, and about 3.5 per cent of inorganic constituents, of which 0.03 per cent was potash. It contained no phosphoric acid, and the total nitrogen content was only 0.02 per cent. It was applied in quantities increasing from about 0.4 to 3 cc. per kilogram of soil. A definite increase in yield was noted in only a very few cases, the increase varying from 11 to 20 per cent. In most cases the waste liquor appeared to be inactive, and even in the largest applications no injurious action was observed. It is concluded that sulphite waste liquors, especially on soils deficient in humus, have no definite fertilizing action, and that the use of this by-product as a fertilizer can not be generally recommended.

Application of liquid sludge to farm land, R. EATON (*Surveyor and Munic. and County Engin.*, 61 (1922), No. 1588, p. 487).—Service experiments on the application of liquid sludge to stiff clay farm land as a method of disposal are briefly described.

The method was found to be cheap and effective, and applicable to activated sludge as well as to tank sludges. The sludge with its manurial constituents is returned directly to the land in one operation. Thirteen years' experience has indicated no ill effects from such treatment. No complications arose during the period from the use of machinery. During the year 1921-22, 36,000 tons of wet sludge were irrigated over the farm land, or roughly 100 tons per day. Three hundred acres are considered to be more than enough to deal with this quantity of sludge.

Disposal of municipal sewage and its industrial utilization, KEPPNER (*Tech. Landw.*, 3 (1921), No. 3, pp. 53-58, figs. 4).—This report describes the uses of sewage and sewage sludge for irrigation and fertilization purposes in different parts of Germany. It deals especially with purification by surface irrigation and spraying on agricultural soils and with purification in fish ponds.

It is stated that some of the difficulties attending the use of direct application of the sewage to the soil are that large fields fitted for the purpose are usually too far distant from cities. The cost of the piping and spraying system is usually high, and the soils are not always adapted for a continuous absorption of the sewage.

In the process of sewage purification in fishponds, it has been found that at least 50 per cent of all suspended matter must first be separated, and the thus mechanically clarified sewage must be diluted with from three to five times its quantity of pure water. Decomposed sewage must not be introduced into a pond, and all fatty substances should be previously separated from the sewage.

Carp and tench, and in certain cases rainbow trout, have been found to be the best fish for this process. It is noted that, contrary to the usual opinion, fish do not eat sewage. The cycle of sewage purification in ponds has been

found to consist of bacterial action, protozoan action, and the action of plants and higher animals, such as crabs, worms, and insect larvae. The fish have been found to feed upon the latter.

The application of fresh sludge to soil is also discussed, and the sewage disposal system of the city of Munich, which disposes of the greater part of the municipal sewage by application to the land, is briefly described.

AGRICULTURAL BOTANY.

Comparative studies on respiration.—XII, A comparison of the production of carbon dioxide by *Penicillium* and by a solution of dextrose and hydrogen peroxid, F. G. GUSTAFSON (*Jour. Gen. Physiol.*, 3 (1920), No. 1, pp. 35–39, figs. 2).—Experimentation similar to that previously described (E. S. R., 46, p. 127) shows that a neutral solution of dextrose and hydrogen peroxid acts like *P. chrysogenum* in producing an increased amount of carbon dioxide upon the addition of acid, but not upon the addition of alkali.

Comparative studies on respiration.—XIII, An apparatus for measuring the production of minute quantities of carbon dioxide by organisms, M. IRWIN (*Jour. Gen. Physiol.*, 3 (1920), No. 2, pp. 203–206, figs. 2).—The purpose of the present article is to describe an apparatus devised by the author, which is said to be a modification of that previously described by Osterhout (E. S. R., 41, p. 524). The manipulation of the apparatus is also indicated.

Comparative studies on respiration.—XIV, Antagonistic action of lanthanum as related to respiration, M. M. BROOKS (*Jour. Gen. Physiol.*, 3 (1921), No. 3, pp. 337–342, figs. 3).—Having in previous papers (E. S. R., 43, p. 820) discussed the relation between respiration and antagonism, including antagonism between monovalent cations and bivalent cations, the author has, in the present paper, extended these studies to trivalent cations as carried out with *Bacillus subtilis*.

It is stated that concentrations of $\text{La}(\text{NO}_3)_3$ up to 0.000025 M have little effect upon the rate of respiration of *B. subtilis*; at 0.000006 M there is an increase in rate, while in higher concentrations there is a decrease in rate. There is well marked antagonism between $\text{La}(\text{NO}_3)_3$ and NaCl, and very slight antagonism between $\text{La}(\text{NO}_3)_3$ and CaCl_2 . It requires a very small amount of $\text{La}(\text{NO}_3)_3$ to antagonize NaCl, the proportions of the two salts at their maximum antagonism being 99.8 parts of NaCl and 0.2 parts of $\text{La}(\text{NO}_3)_3$.

Comparative studies on respiration.—XV, The effect of bile salts and of saponin upon respiration, M. M. BROOKS (*Jour. Gen. Physiol.*, 3 (1921), No. 4, pp. 527–532, figs. 3).—Experimentation, employing the same technique as formerly (E. S. R., 43, p. 820) in testing the behavior of tissues under the influence of sodium taurocholate, showed that the addition of this salt produces an increase in the rate of respiration at a concentration of 0.0000125 M and a decrease at 0.001 M and in higher concentrations. NaCl is antagonized by sodium taurocholate, the most favorable proportion being 14,375 parts of NaCl to 1 part of sodium taurocholate (molecular proportions). Solutions of saponin, at concentrations from 0.00005 to 0.001 M, decrease the rate of respiration; lower concentrations produce no effect.

Comparative studies on respiration.—XVI, Effects of hypotonic and hypertonic solutions upon respiration, O. L. INMAN (*Jour. Gen. Physiol.*, 3 (1921), No. 4, pp. 533–537, figs. 2).—Employing the method of measuring respiration described by Osterhout (E. S. R., 41, p. 524), the author undertook to measure the production of carbon dioxide while the osmotic pressure of the medium was changed sufficiently to be highly hypertonic on the one hand and

quite hypotonic on the other. The marine alga *Laminaria agardhii* was used as the basis of most of the work, the results with *Ulva lactuca* being quite similar.

It was found that the rate of respiration of *L. agardhii* is rapidly reduced in highly hypertonic solutions of sea water, and somewhat less rapidly in highly hypotonic solutions. Hypertonic solutions of NaCl, CaCl₂, and mixtures of NaCl and CaCl₂ in the proportion of 50:1, all caused a decrease in the rate of respiration of wheat seedlings.

Comparative studies on respiration.—XVII, Decreased respiration and recovery, O. L. INMAN (*Jour. Gen. Physiol.*, 3 (1921), No. 5, pp. 663-666, figs. 3).—Having shown in the above paper that exposure to hypotonic or hypertonic solutions may greatly lower the production of carbon dioxide by *Laminaria agardhii*, the author sought in the present work to determine whether the respiration would become normal when the plant was replaced in sea water.

It is shown that in strongly hypertonic sea water respiration steadily decreases, and that the degree of recovery depends on the length of the exposure. After an exposure of 5 minutes, recovery is practically complete. As the period of exposure is lengthened, recovery is less and less complete, no recovery occurring when the exposure amounts to 20 minutes.

It is regarded as possible that when recovery is incomplete none of the cells are killed but that their respiration is permanently decreased. It is thought possible also that some cells continue to respire normally while others are killed, and that it is the death of these cells which prevents complete recovery.

The mechanism of injury and recovery, W. J. V. OSTERHOUT (*Jour. Gen. Physiol.*, 3 (1920), No. 1, pp. 15-20, figs. 2).—During the process of death the electrical conductivity of many tissues undergoes a change in electrical resistance by means of which the process may be followed with considerable precision. This may be taken advantage of to measure injury and recovery. *Laminaria* has been utilized in this connection (E. S. R., 45, p. 527). This plant after exposure for 5.2 minutes in 0.52 M NaCl shows a fall to 94.6 per cent of the resistance it had in sea water, a return to which raises it, practically, to the normal value. This rise of resistance may be termed recovery. These facts are shown quantitatively by curves, which also indicate the limitations of recovery.

In *Laminaria*, recovery may be partial or complete, according to circumstances, and this is true of all the plants investigated by the author, namely, *Ulva*, *Rhodomenia*, and *Zostera*. It appears to be true also of frog skin, which has been partially investigated.

Though recovery is usually regarded as due to the reversal of the reaction which produces the injury, the author holds a fundamentally different conception, assuming that the reactions involved are irreversible (or practically so), and that injury and recovery differ only in the relative speed at which certain reactions take place.

A theory of injury and recovery.—II, Experiments with mixtures, W. J. V. OSTERHOUT (*Jour. Gen. Physiol.*, 3 (1921), No. 4, pp. 415-429, figs. 8).—Having shown (E. S. R., 46, p. 128) that changes in the electrical conductivity of *Laminaria* can be predicted with considerable accuracy by means of certain equations, and having assumed that the same equations should make it possible to predict the changes produced by transferring tissue from sea water to mixtures of NaCl and CaCl₂, and then replacing the plant in sea water, the author tested this theory by means of experiments made with a variety of mixtures and was able to confirm the assumption.

In this and preceding papers a quantitative theory is developed in order to explain the toxicity of NaCl and CaCl₂, the antagonism between these substances and the fact that recovery (in sea water) may be partial or complete, depending on the length of exposure to the toxic solution.

A theory of injury and recovery.—III, **Repeated exposures to toxic solutions**, W. J. V. OSTERHOUT (*Jour. Gen. Physiol.*, 3 (1921), No. 5, pp. 611-622, figs. 5).—In order to test the theory developed in previous papers as to the behavior of tissue transferred from one toxic solution to another, a variety of experiments was made in which the tissue was exposed to several solutions in succession.

The experiments and calculations were carried out as previously described, and it was found that tissues of *Laminaria* transferred from sea water to solutions of pure salts, and thence to other solutions of pure salts or to sea water, behave in a manner which can be predicted by means of the equations previously developed. The behavior of the tissue may be explained as due to a series of catenary reactions. It is possible that a similar explanation may be applied to other fundamental life processes.

[**Osmotic conditions in the plant cell**], K. HOFER (*Ber. Deut. Bot. Gesell.*, 38 (1920), No. 8, pp. 288-293, figs. 4).—A discussion is given applying chiefly to four concepts as used in connection with the plant cell, namely, osmotic value, turgor tension, turgor pressure, and suction.

The influence of saponin on plant cells, F. BOAS (*Ber. Deut. Bot. Gesell.*, 38 (1920), No. 10, pp. 350-358).—The preliminary report of studies which is here made includes data on saponin in relation to alcoholic fermentation and to the vital coloration of yeast, also data on the influence of saponin on cells of a few higher plants.

Saponin usually promotes the withdrawal of material from the cells, the combinations of saponin with neutral salts being notably more effective in this regard. In studies on cells of higher plants, no clear difference between the influence of univalent and that of polyvalent cations could be detected.

The effects of neutral salts on the acid resistance, permeability, and life duration of protoplasts, W. BRENNER (*Ber. Deut. Bot. Gesell.*, 38 (1920), No. 8, pp. 277-285).—Following up certain features of work previously noted (E. S. R., 45, p. 733), the author studied acid resistance and permeability in the presence of neutral salts and the life duration of protoplasts in various salt solutions. The results are given in tabular form with discussion.

Carbon dioxide on plant growth, BORNE-MANN (*Zentbl. Agr. Chem.*, 50 (1921), No. 8, pp. 296-299).—Undertaking to prove that the increase in productivity in soil which has been given plenty of stable manure and good cultivation is due largely at least to the increase in the supply of carbon dioxide given off in such soil, the author has experimented with six cultivated plants supplied with carbon dioxide by means of an arrangement which is described.

The increase in yield attributed to the carbon dioxide supply was in case of peas 47 per cent (seed weight), of potatoes 42.6 (tubers), onions 210, and kohlrabi 19.8 per cent.

The carbon dioxide nutrition of plants, O. LEMMERMANN (*Zentbl. Agr. Chem.*, 50 (1921), No. 8, pp. 299-304).—Studies described, investigating to what extent stable manure and green manures may serve as source of carbon dioxide for utilization by growing plants, are not considered when taken as a whole to substantiate the view that the carbon dioxide present in soil as a result of decomposition of the organic substances is of practical importance in the growth of plants.

The occurrence and distribution of manganese in plants (*Kentucky Sta. Rpt.* 1921, pt. 1, pp. 36, 37).—Experiments are noted in which garden peas, soy

beans, cowpeas, corn, and buckwheat were grown in pots containing sand as free as possible from manganese, which was added to one series. It was found that the growth of the plants in the pots to which no manganese was added was arrested before they attained the size of the controls and the plants showed signs of malnutrition, while those which received manganese continued thrifty. These experiments are believed to show that manganese performs an important function in connection with the assimilation of carbon and the production of chlorophyll.

Pot experiments with manganese on acid soils showed that a small amount of manganese sulphate had a toxic effect on the plants, but after the acidity was corrected by the addition of calcium carbonate the effect of the manganese was found to be beneficial.

Physiological studies of the effects of formaldehyde on wheat, W. M. Atwood (*Phytopathology*, 11 (1921), No. 2, p. 103).—The question of the actual entry of formaldehyde appears to have been answered in the affirmative by microchemical tests and by measurement of the imbibitional behavior of seeds in formaldehyde solutions. The principal studies thus far have been directed toward a determination of the effects of formaldehyde of varying concentration upon the respiration of the wheat as measured by carbon dioxide output. Studies extending over two seasons seem to have established the fact that there is a marked depression of respiratory rates for wheat treated to formaldehyde at a concentration of 1 part to 80 parts of water. Preliminary studies of the respiratory rates of seedlings from treated and untreated seed seem to show a marked effect of the formaldehyde in slowing down metabolism subsequent to germination.

The results [on sex of progeny] of fertilization with pollen of various ages, F. LILLENFELD (*Biol. Zentbl.*, 41 (1921), No. 7, pp. 296–303).—This discussion of results from experimentation with *Cannabis sativa* centers in the statement that the sum of all the conditions, the influence of which on the sex ratio of progeny was here subjected to experimental tests, may be summed up in the word “age” (or aging). By this expression should be understood a complex of alterations occurring between two points of time in the life of an organism or an organ, regarding which complex very little is at present known.

Reversal of the sexual state in certain types of monoecious inflorescences, J. H. SCHAFFNER (*Ohio Jour. Sci.*, 21 (1921), No. 6, pp. 185–200, figs. 51).—On the basis of studies here outlined, it is claimed that in plants sex is due to a state or condition; that in the same general tissue system some cells may be in the female state, some in the male state, and some in the neutral state; and that each state is quantitative, exhibiting a greater or less degree of intensity. It is also claimed that the sexual state has no direct relation whatever to a segregation or association of chromosomes with a possible homozygous or heterozygous relation to hypothetical sex factors. It is considered that sexual states usually arise during the vegetative growth of the cells or tissues, that they must in most cases, at least, come from neutral states, and that they are often easily reversible, the female to the male or the male to the female. The phenomena of maleness, femaleness, and neutrality as regards cells, tissues, organs, or entire individuals do not come under the category of hereditary units or factors in the ordinary sense and are certainly not Mendelian. Sexuality will probably find its final explanation in relation to the somewhat similar physical and chemical phenomena, such as electricity, magnetism, ionization, and electrons.

Grafting experiments, R. LIESKE (*Ber. Deut. Bot. Gesell.*, 38 (1920), No. 10, pp. 353–361).—Studies are briefly detailed on grafting cucurbits, legumes, and other plants.

Inventories of seeds and plants imported by the Office of Foreign Seed and Plant Introduction during the period from January 1 to December 31, 1919 (*U. S. Dept. Agr., Bur. Plant Indus. Inventories Nos. 58 (1922), pp. 56, pls. 4; 59, pp. 77, pls. 4; 60, pp. III+87, pls. 7; 61, pp. III+88, pls. 6*).—Annotated lists are given of seeds and plants introduced for testing in this country during 1919, a total of more than 2,100 lots having been secured through various agencies.

FIELD CROPS.

Agricultural experiment: Its design and interpretation, E. PARISH (*Union So. Africa Dept. Agr. Sci. Bul. 22 (1922), pp. 21, figs. 2*).—This publication considers the magnitude of the error due to soil difference and other causes and its measurement, and treats briefly of plat size and replication, varietal trials, cooperative experiments, probable error in feeding trials, and feeding experiments for milk production.

[**Field crops work at the Georgia Coastal Plain Experiment Station, 1921**] (*Georgia Coastal Plain Sta. Bul. 2 (1922), pp. 7-25, 27, 28, figs. 11*).—Georgia Red bluestem wheat, and C. I. 4159 wheat were outstanding with 31.8 and 26.3 bu. per acre, respectively, and both had early maturity and marked resistance to stem rust. Texas Red Rust Proof with 62.5 bu. was first among oats varieties. Time of seeding apparently has more influence on the yield of oats than any other factors studied in the tests, about November 1 seeming to be the best date in the section. An application of ammonium sulphate made February 1 as a top-dressing on oats gave the largest returns. Abruzzi rye with 38.3 bu. and South Georgia rye with 35.1 bu. decidedly outranked Virginia and Rosen rye. Hannchen barley gave promise of value in the section.

Cotton dusted with calcium arsenate for boll weevil control averaged 198 lbs. of seed cotton per acre more than untreated cotton. Petty Toole, Poulnot, and Dixie led the poisoned varieties and College No. 1, Petty Toole, and Poulnot were first among the untreated sorts. Cotton responded more readily to phosphorus and potassium than to nitrogen, apparently because a legume crop was grown previously on the plat.

Marlboro, Whatley, Puckett, and Hastings, prolific with yields from 62.6 to 53.4 bu. per acre, were leaders in tests of corn varieties. Results of fertilizer trials with corn are tabulated without comment.

The Bunch velvet bean is indicated as promising in the coastal plain. Although the yield of beans was low, the vines did not pull down or materially affect the yield of corn. Velvet beans of the 120-day variety in every row with corn made 150 lbs. of beans per acre, in every other row with corn 75 lbs., in alternating rows of beans and corn 75 lbs., and one row of beans to two rows of corn 58 lbs. The corresponding yields of corn amounted to 6.6, 9.1, 11, and 12.6 bu. per acre, respectively. North Carolina and Spanish peanuts gave highest yields of nuts on both fertilized and untreated areas. The Spanish variety, spaced in 6 in. in the drill, yielded 2,625 lbs. of unhulled nuts per acre, as compared with 2,375 lbs. from 12-in. spacing. Although planted adjacent to cowpea varieties, the grain crop of which was destroyed by the pod weevil, soy beans were not affected by pests of this nature. Black soy beans led in hay yield with 3,040 lbs., and B. P. I. 37,250 gave the maximum seed production, 19.5 bu. per acre. The yields of grasses and summer legumes for hay are tabulated, and notes are included on vetch and alfalfa varieties and on kudzu.

Carpet and Dallas grasses have given decidedly the best results of pasture grasses under observation. *Medicago rigidula* was far more drought resistant than other varieties of bur clover tested, made a vigorous growth, and seeded

freely. The best results in establishing a grazing crop were obtained where the native vegetation was destroyed and the soil allowed to become firm. Since heavy burning over a large area would be impractical, it appears that new land scarified with a disk harrow or plowed shallow with a one-horse scooter and allowed to pack before seeding, should give good results. Maximum germination was secured on new land where the brush was burned, and the next best on new land scootered or disked with a harrow. In an attempt to establish a carpet grass pasture, rather heavy grazing over low wet land proved helpful in keeping down the growth of native vegetation.

York Yam and Red Bermuda sweet potatoes, with 43.6 and 40 bu. per acre, led in total yields, while Triumph and Golden Beauty were first in production of No. 1 roots. Although a combination of three elements produced the best results with sweet potatoes, it appears that acid phosphate had a relatively greater influence than any of the other fertilizer ingredients used on new land. Varying the amounts of 9-2-3 fertilizer from 200 to 1,000 lbs. per acre produced consistent increases up to 600 lbs.

Preliminary work with tobacco in cooperation with the U. S. Department of Agriculture is also noted.

[Field crops work in Kentucky, 1921] (*Kentucky Sta. Rpt. 1921, pt. 1, pp. 37, 38-40, 41, 42, 43, 45, 46*).—The results so far in studies of the relation of chemical characters to quality of leaf tobacco show that in White Burley the nitrogen and nicotin contents of wrappers differ from those of fillers and smokers. Although the nicotin content of good kinds of a given grade of White Burley usually is much larger than that of common, such great differences are not shown in the nitrogen content of good and common types of the same grade, suggesting that the common type may have nitrogen in some form tending to make the tobacco inferior. White Burley seems to contain more nitrogen and nitrate and less nicotin than dark tobacco. The ash of White Burley apparently contains more phosphorus, potassium, and calcium, and less silicon and magnesium, than that of dark tobacco.

A treatment including 200 lbs. sodium nitrate, 100 lbs. potassium sulphate, and 200 lbs. acid phosphate gave the maximum average increase in fertilizer experiments on burley tobacco in a rotation of wheat 1 year, clover and blue grass 3 years, and tobacco 2 years. The quality of burley was best in rotations of wheat, clover, orchard grass, and tobacco, either untreated or where the tobacco received 20 tons of manure or 200 lbs. of sodium nitrate per acre. The quality in the 3-year rotations was best where tobacco followed 2 years of redtop. Strains of Standup White Burley resistant to root rot were earlier and more uniform in growth and type than varieties commonly grown.

Both sodium nitrate and ammonium sulphate gave favorable results with hemp. The use of amounts of commercial nitrogen varying from 100 to 400 lbs. per acre, applied to corn both at planting time and when waist high, gave no increase in yield.

Hardy strains of alfalfa such as Grimm and Dakota greatly outyielded the common strains in 1921, because of unusual, severe freezes in late March and early April.

A concise account is given of practices involved in marketing blue grass and orchard grass seed, and producing areas in Kentucky and the United States are indicated.

A complete series of fertilizer applications to Irish Cobbler potatoes on blue grass sod land gave no consistent beneficial results on the yield, agreeing with findings with other farm crops on this soil. Triumph was much earlier than Cobbler or Early Ohio and gave a fair return, but Cobbler outyielded all other

varieties in both early and second crops. Green Mountain and Rural Russet made the best showing among late varieties. Selected strains of Kentucky-grown Cobbler stock yielded about equal to the best certified strains obtained elsewhere.

A test of the keeping quality of sweet potatoes has been noted (E. S. R., 46, p. 135).

Domestic fiber crops, G. SELLERGREN (*K. Landtbr. Akad. Handl. och Tidskr.*, 59 (1920), No. 7, pp. 484-490, figs. 3).—A historical review of the use of the nettle (*Urtica dioica*) as a source of fiber for the manufacture of cloth, a description of the processes of preparing the fiber, and a discussion of the morphology of the nettle plant as related to the production and the value of the fiber. The economic advantages and disadvantages of the use of the fiber are briefly noted.

A handbook of some South Indian grasses, K. RANGA ACHARIYAR and C. TADULINGA MUDALIYAR (*Madras: Govt.*, 1921, pp. 318, figs. 228).—Detailed descriptions are given for about 100 grasses of wide distribution in the plains of South India, together with keys to tribes, genera, and species. Considerable information is included on the general anatomy, vegetative organs and their histology, and the inflorescence of typical grasses.

Alfalfa root studies, S. GARVER (*U. S. Dept. Agr. Bul.* 1087 (1922), pp. 28, figs. 19).—Studies made on the roots of Peruvian, Poona, southern-grown common, northern-grown common, Turkestan, Grimm, and yellow flowered alfalfa grown under like conditions at Redfield, S. Dak., are reported; the factors tending to produce modifications of taproots in alfalfa, including soil, climate, cultural treatment, and injuries are discussed; and the type of roots characteristic of the best-known varieties of alfalfa are described, illustrated, and compared.

The root systems of Peruvian and Poona alfalfa of one season's growth are quite similar, being characterized by small, upright crowns, distinct taproots, comparatively few branch roots, and few fibrous roots which are distributed rather uniformly over the root system. Poona alfalfa seldom has branch roots on the upper portion of the taproot. The southern-grown common and the northern-grown common alfalfas have distinct taproots and generally show considerable similarity. The northern-grown strains have somewhat broader crowns and exhibit a greater tendency to throw out branch roots and fibrous roots, but these differences are not conspicuous characteristics. Both types exceed the Poona and Peruvian alfalfas in branch and fibrous root development. Practically no difference is observed in the diameter of the taproot.

Turkestan alfalfa is characterized by broader, deeper-set crowns, more branch roots, and shorter, more tapering taproots than the common and non-hardy alfalfas. The root system of Turkestan is very similar to that of Grimm. Grimm alfalfa has broad, deep-set crowns and numerous branch and fibrous roots. Little difference exists between the diameters of the taproots of Turkestan and Grimm, but both somewhat exceed common and nonhardy strains in this respect. They are also similar in the angle which the branch roots form with the taproot. This angle is greater than in less hardy varieties studied, but is not a conspicuous characteristic. Fibrous roots are distributed over the root system, and rooting rhizomes are well developed.

The forms of *Medicago falcata* are characterized by broad, deep-set crowns and an abundant development of fibrous roots and branch roots, exceeding all the other alfalfas studied in these respects. Crown branches and rhizomes are small and numerous, and the angle of divergence is greater than in the variegated and common alfalfas. Based upon manner of growth, *M. falcata* forms may be grouped as follows: Erect plants with relatively small but quite dis-

tinct taproots and numerous small, slowly tapering branch roots; prostrate plants with very broad, deep-set crowns, well-developed rhizomes, dense root systems, and taproots either absent or very indistinct; and the decumbent form, intermediate between the other two forms, with indistinct, short, and rapidly tapering taproots. The latter strain had the most extensive root systems of all the alfalfas studied.

The root systems of the least hardy forms of purple-flowered alfalfa may be distinguished from the most hardy hybrid and yellow-flowered alfalfas with accuracy, but the intermediate forms are not distinct enough to be distinguishable from one another or invariably from some forms of the nonhardy or yellow-flowered alfalfas.

Corn investigations, T. A. KIESSELBACH (*Nebraska Sta. Research Bul. 20* (1922), pp. 151, figs. 36).—A study of some of the physiological characteristics of the corn crop is reported, together with comparisons of various selection, breeding, and cultural practices in their relation to grain yields. Part of the investigation continues and extends work reported by Montgomery et al (E. S. R., 25, p. 832; 27, p. 432; 28, p. 232; 29, p. 333). Adaptation studies with corn (E. S. R., 45, p. 230) and studies on the freezing of seed corn (E. S. R., 42, p. 437; 43, p. 827) have already been noted in detail.

Continuous selection within a commercial corn variety during four years for opposite extremes in the ratio of leaf area to dry plant substance resulted in 7 high leaf area and 9 low leaf area strains, in which the former averaged 23 per cent more leaf area per unit dry matter, 29 per cent greater actual leaf area and 5 days later maturity than the latter. These and other data suggest superiority of the low leaf over the high leaf area strains, but also with some reduction in yield resulting from narrow breeding caused by too restricted type selection. In selection tests with Nebraska White Prize, Reid Yellow Dent, and Hogue Yellow Dent during various periods, long, slender, smooth seed ears, outyielded the deep rough seeded ears. Measurements and observations led to the conclusion that ear type selections indirectly result in a selection of the correlated plant characteristics, which differ in their adaptation to various environmental conditions.

In an extensive 1-year comparison of disease-free ears with ears infected with root-rot diseases, as determined by the germinator test, no advantage resulted in regard to grain yield, barrenness, lodging, or soundness from such disease-free selection. When ear-to-row plats in this test were classified into rough, medium, and smooth groups without reference to root-rot diseases, the respective relative yields of shelled grain per acre were 100, 103, and 106, as compared with 102 for the original unselected corn. Correlation of germinator results with various ear and kernel types indicates from 10 to 20 per cent greater freedom from root-rot diseases with the slender smooth ear with horny kernels than with the large, rough, starchy, deep-grained ear. It seems possible to the author that the increased yields secured by some investigators following selection of disease-free ears by the germinator test is associated to some extent with their prescribed preliminary selection of the smooth, slender, horny ears for seed purposes.

Where seed was grown under field conditions of promiscuous pollination, the progeny showed a tendency to come true to the ear type planted.

During five years of continuous selection and testing of ears high v. ears low on the stalk, spreads of 23 per cent in ear height and 10 per cent in stalk height based on the low ear selections resulted. The low ear selections yielded 3.9 per cent more grain than the high ear, but 3 per cent less than the original corn. Seed ears from standing plants yielded 10.9 per cent more than

from lodged plants and 2.9 per cent more than from the original corn. Ears borne erect on the stalk and ears drooping yielded, respectively, 5.1 and 0.7 per cent less than the original corn. Comparisons of seed from butts, tips, and middles showed little to be gained from discarding butts or tips, aside from a more even stand and better germination under certain conditions of freezing injury. Corn selected when fully matured and at five weekly intervals before maturity yielded, respectively, 64.5, 64, 65, 63, 64, and 63.4 bu. per acre, suggesting that slightly immature seed would not be objectionable if properly cured.

Comparisons of four methods of ear-to-row breeding, differing primarily in the manner of continuing the high yielding strains as established in the initial ear-to-row tests, indicated that improvement in yield of an adapted variety through ear-to-row breeding seems rather uncertain, a maximum increase of only 2.6 per cent being attained in the experiments. In the initial ear-to-row tests, the strains continued in the experiments had yielded about 20 per cent more than the original corn. No actual improvement seemed to result from continuous detasseling of the apparently inferior stalks. It does not appear advantageous to select seed from corn planted thicker than three plants per hill, the standard rate for eastern Nebraska, or from a stand as thin as one plant per hill.

Self-fertilization seems not to exceed 1 per cent under Nebraska conditions, only 0.7 per cent of the kernels being actually selfed under natural field conditions in the tests. Seed from detasseled rows in a seed plot yielded 0.6 per cent more than seed from normally field pollinated rows, indicating that no extensive self-fertilization took place. The immediate effect upon the current crop was an increased grain yield of 1 per cent for the detasseled plants. Extensive observations showed that generally the pollinating period of the tassel materially overlaps the silking period, and self-pollination might occur widely except for the high proportion of foreign pollen in the air.

Over 100 distinct pure lines or elemental strains were developed by continuous self-fertilization for seven or more years. In a 7-year test, 8 to 12 inbred strains of Hogue Yellow Dent composited produced 32 per cent as much grain as the original corn. Eight inbred strains of Nebraska White Prize corn composited yielded 35 per cent as much as the original corn. The use of the lowest yielding pure lines as one parent resulted in hybrid yields of 13.5 bu. less per acre than where both inbred parents were relatively higher yielding. Comparative yields indicated that crossing the more productive pure lines is likely to result in the most productive hybrids. Although the grain yields in a 4-year test of 8 F_1 hybrids between pure lines averaged 9.7 per cent more than the original corn during two years, their plant development was smaller, doubtless indicating both the complete elimination of some deleterious factors present in the original variety and also the isolation and recombination of superior factors through the inbreeding and hybridizing processes, rather than a correlation between grain production and vegetative vigor as measured in plant size.

During two years, 29 F_1 hybrids between pure lines derived from plant types partially fixed by continuous plant type selection for either a high proportion or a low proportion of leaf area per unit of mature dry plant weight were compared with the original corn. The yield and other agronomic data indicated that the outcome of inbreeding and hybridizing experiments may be quite extensively directed through previous selection. In a 2-year test, in which 7 F_1 and F_2 hybrids were compared with the original corn, the respective relative yields were 125, 67, and 100, showing very definitely the inadvisability of selecting seed corn from an F_1 hybrid between such pure lines regardless of the productivity of the F_1 .

In a 4-year test the yield of 13 hybrids between ordinary commercial varieties average 4 per cent less than the average of both parents and 9 per cent less than the best parent. No hybrid equaled the best variety parent in grain yield. This behavior may be accounted for by the fact that the varieties are already fully heterozygous, and for the same reason the F_2 of the variety hybrids yielded fully up to the F_1 generation. A similar situation was found in the immediate effect of crossing upon kernel weight. In these experiments the immediate effect of foreign pollen from one commercial variety upon another was negligible, whereas hybrid kernels on pure line ears were increased relatively an average of 11 per cent. Nothing in the data suggested that the results from comparative tests of commercial varieties of dent corn, as now conducted, are seriously invalidated because of any complicating immediate effect of fertilization by foreign pollen.

A histological study of 10 pure line hybrids and their pure line parents indicated that the increased growth of the hybrid has its basis in both increased size and increased numbers of cells, about 90 per cent of the gain in plant size resulting from increase in cell numbers and 10 per cent from increase in cell size.

Comparisons of several different degrees of inbreeding as applied to ear-to-row strains differing in the possibility of related gametes being involved in the fertilization process gave indications that any selection or breeding practice which so restricts the breadth of the parental relationship as to increase the chance of identical Mendelian factors being paired on fertilization is likely to give reduced yields.

The yields from two varieties planted for several years at rates ranging from 1 to 5 plants per hill in hills 3.5 ft. apart indicated that there may be considerable variation in stand, fluctuating about 3 plants per hill under the station conditions without a material effect on yield. Methods of distribution, including uniformly 3 plants per hill, alternating hills with 2 and 4 plants, alternating hills with 1, 2, 3, 4, and 5 plants, and alternating hills with 1, 3, and 5 plants gave respective 5-year average yields of grain per acre of 59, 59.2, 58.6, and 56 bu.

Corn culture, G. R. QUESENBERRY (*New Mexico Sta. Bul. 132 (1922), pp. 43, figs. 11*).—Corn, the most important crop in New Mexico, is grown in every county, but its production centers in the northeastern quarter of the State. Cultural methods and varieties for grain and silage are recommended for the irrigated valleys, high altitudes, and dry-land areas. In addition to notes on weeds, insects, and diseases, the methods and varieties employed in representative counties are outlined by county agents in appended statements.

Dwarf Mexican June is the principal variety in the dry-land sections, standard Mexican June predominates in the irrigated valleys, and Swadley, Northwestern Dent, Minnesota 13, and early strains of Iowa Silvermine and Reid Yellow Dent are commonly grown in the higher altitudes. The Indian soft and flint corns are produced quite extensively where the native and Indian population is in the majority. Mexican June led in yield both under irrigation in the station tests and on dry land at Tucumcari. Iowa Silvermine, Hickory King, and Reid Yellow Dent also gave good returns under irrigation.

Early plantings were found to grow slower and with a smaller total tonnage than later seedings. Seed dropped by hand in furrows gave decided increases over that seeded with a planter. A table shows the amount of seed of different varieties required to plant 1 acre with spacings from 40 by 12 in. to 40 by 30 in. Irrigating after seeding produced better stands and yields than irrigating before seeding. On heavy soils at the station 10 in. of water produced 22.5 bu. of corn per acre, and the yield rose to 65.5 bu. with an increase of water up

to 24 in., but a precipitous decline in yield followed the further application of water.

[**Potato investigations in Germany in 1920**], P. KNORR (*Arb. Forschungsinst. Kartoffelbau*, No. 6 (1922), pp. 1-114, 121-128).—Experimental results with potatoes (E. S. R., 46, p. 533) from cultural, rotation, variety, fertilizer, seed, and planting tests, seed production and breeding work, and harvesting and storage trials carried on at 23 experimental centers in Germany are summarized for the year 1920.

[**New varieties of rape**], N. SYLVÉN (*Sveriges Utsädesför. Tidskr.*, 32 (1922), No. 2, pp. 92-98, fig. 1).—The origin of two new varieties of rape, known as Svalöf Primraps and Svalöf Senraps, is discussed, and their yielding capacity, as compared with other strains, is reported. The results secured indicated that Primraps is an early variety producing high yields of seed, and that Senraps is a late variety well adapted to forage production. Both varieties have a strong stem and are regarded as valuable for the production of green forage.

[**The influence of injury on development and yield of rye**, O. SCHLUMBERGER (*Mitt. Biol. Reichsanst. Land. u. Forstw.* No. 21 (1921), pp. 56, 57).—Additional studies (E. S. R., 46, p. 232) on the effect of injury on yield and development of rye concerned the loss of and injury to culms.

Loss of shoots generally led to noticeable aftergrowth, making up the loss in increased numbers. The aftergrowth was greater following the loss of secondary shoots than after the loss of main culms. The greater part of the aftergrowth either did not develop heads or else produced defective spikes. The grain yields were 35.9 per cent less where the main culm was removed, and 49.6 per cent less following the loss of secondary shoots, and the grain was poor in quality. Straw losses of 23.1 and 30 per cent, respectively, were noted.

[**A cheap and efficient method of propping sugar canes**, T. S. VENKATRAMAN (*Agr. Jour. India*, 17 (1922), No. 4, pp. 416-418, pl. 1).—The method outlined is employed at the Sugar Cane Breeding Station at Coimbatore to prevent lodging of sugar cane.

[**Group classification and varietal descriptions of American varieties of sweet potatoes**, H. C. THOMPSON and J. H. BEATTIE (*U. S. Dept. Agr. Bul.* 1021 (1922), pp. 30, pls. 8).—In this system of classification, designed for investigators, teachers, and growers, known varieties of sweet potatoes are classified into eight groups, each named from the most widely known variety or the variety most typical of the group. A key describing the leaves, stems, and roots of each group is included, together with detailed descriptions of the groups and of their component varieties. A check list of names used in sweet potato literature and an extensive bibliography on sweet potatoes are appended. A study of sweet potato varieties with reference to their canning quality has been noted (E. S. R., 47, p. 613).

[**The influence of isolation on seed production of timothy**, H. WITTE (*Sveriges Utsädesför. Tidskr.*, 32 (1922), No. 2, pp. 87-91).—The results are reported of experiments conducted to determine the effect of isolation on the setting of seed by timothy. The isolation of the spike was effected by bagging. The article is summarized in German.

Under normal conditions 88 plants gave an average of 37.1 seeds per centimeter of spike length, while 142 plants with the spikes bagged produced an average of only 3.3 seeds per centimeter of spike length. Observations made on 3 groups of 8 plants each showed that the first group, growing under natural conditions, produced 42 seeds; the second group with spikes bagged and the blossoms fertilized only through self-pollination produced 2.3 seeds; and the third group with the spikes bagged, but with provision for some cross-

pollination by including in the bag a spike of another plant, produced 6.1 seeds per centimeter of spike length. These results are regarded as indicating that the concurrence of sterile, semisterile, and self-fertile types must be taken into consideration in breeding work with timothy. Two plants of the first group producing no seed, either with or without isolation, are believed to be instances of female sterility.

Wheat, cultural notes, I. E. THATCHER (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 9-10, pp. 138-143, fig. 1).—Recommendations are made concerning rates (E. S. R., 46, p. 334) and dates (E. S. R., 44, p. 141) of seeding wheat and preparation of the seed bed in Ohio, based on experiments by the station and Ohio State University.

A rate of from 6 to 8 pks per acre is held advisable. While the prevalence of Hessian fly (E. S. R., 44, p. 163) governs the date of seeding to a large extent, the best date appears to be September 22 in Wayne County, September 29 in Meigs and Miami Counties, and October 6 in Clermont County. In a combined rate and date of seeding test, 10 pks. produced a greater 6-year average acre yield than 6 or 8 pks. seeded September 15, but smaller average yields when seeded 10, 20, 30, and 40 days later. The quality of the grain in this test decreased with the later dates of seeding. Comparisons of methods and dates of seed-bed preparation indicated that early plowing of stubble or sod ground for wheat is preferable to disking or later plowing.

Experiments and observations on the quality of Swedish varieties of wheat, Å. ÅKERMAN (*Sveriges Utsädesför. Tidskr.*, 32 (1922), No. 2, pp. 63-86, figs. 2).—This article represents a paper presented at a meeting of the Swedish Wheat Growers' Association, March 15, 1922, and reviews the improvement in the quality of Swedish varieties of wheat, notes briefly results obtained by a number of Swedish and other investigators of the quality of wheat flours, and reports the results of recent experiments on the baking quality of Swedish wheats, including several of the newer varieties.

It is shown that six varieties of wheat grown at Svalöf in 1921 ranged in gluten content from 8 to 9.7 per cent, and in the volume of bread produced per 100 gm. of flour from 362 cc. to 498 cc. Extra Kolben spring wheat, ranking highest in volume of loaf and in gluten content, produced the best quality of dough and bread. In general the volume of loaf, gluten content, and quality of dough were closely correlated. In several similar experiments conducted in 1920 and 1921 in other parts of Sweden, a common variety known as Swedish Sammets wheat showed the highest baking value among the varieties compared. These results are regarded as pointing out the necessity of improving the baking quality of the more recently originated varieties of wheat for Sweden.

Milling and baking studies with wheat, W. O. WHITCOMB, W. F. DAY, and M. J. BLISH (*Montana Sta. Bul.* 147 (1921), pp. 23, figs. 7).—Data are reported from preliminary tests to determine the relative milling and baking value of frosted wheats of three varieties grown under irrigation during 1917, 1918, and 1920. An earlier contribution on the effect of premature freezing on the composition of wheat has been noted (E. S. R., 43, p. 501). Although the results seem to indicate a higher value for frosted wheat than is ordinarily assigned in the market, that value has not been determined and definite conclusions are not considered justified.

The addition of nonprotein nitrogen extract from badly frosted durum wheat to sound flour resulted in a perceptible increase in loaf volume as compared with the untreated check. Adding amino acids from gliadin, from gelatin, and from casein to sound wheat flour gave results quite similar to those obtained from the use of the nonprotein nitrogen extract from frozen wheat. This is

held to be a reasonably positive proof that small amounts of amino acid mixtures increase the loaf volume, provided other conditions are normal.

Aging of flour from the 1917 crop of sound wheat from February, 1920, to June, 1921, gave a beneficial effect in all the factors considered in the baking test, whereas aging the flour from the 1917 frosted wheat for the same period gave a poorer loaf than when baked soon after milling. Aging the frosted wheat, however, from March, 1920, to June, 1921, and then milling and baking, resulted in a marked improvement in the loaf volume with little or no change in the other baking factors.

The relative bread-baking values of certain varieties of common spring, durum, and winter wheat are tabulated.

Comparative milling and baking values of Kanred, Black Hull, and Turkey Red Oklahoma wheat. H. F. VAUPEL (*Grain Dealers Jour.*, 49 (1922), No. 5, p. 340).—Milling and baking studies were made in cooperation with the Oklahoma Experiment Station on samples of Kanred, Black Hull, and Turkey Red wheat from the "hard winter" section of Oklahoma.

Black Hull averaged highest in milling value, while Kanred and Turkey Red were about equal. The average test weight was for Kanred 58.8 lbs. per bushel, Black Hull 61, and Turkey Red 58.8 lbs.; the protein content averaged 11.32, 10.67, and 11.56 per cent, respectively; the average absorption amounted to 63.1, 58.3, and 63.5 per cent; and the loaf volumes averaged 2,275, 1,995, and 2,405 cc. Flour of Black Hull resembles flour of soft wheat varieties when comparing absorption and loaf volumes, and lacks strength. In comparisons of direct baking values, Turkey Red proved to be the best and Black Hull the poorest of the three varieties.

The certification of farm seeds (*Dakota Farmer*, 42 (1922), No. 14, p. 516).—An outline of the system of farm crop seed certification of the South Dakota Experiment Association, with requirements for certified seeds and a list of standard varieties.

North Dakota weeds. O. A. STEVENS (*North Dakota Sta. Bul.* 162 (1922), pp. 3-44, figs. 45).—The general habits of weeds are described, and prevention, eradication, and control measures are discussed. Descriptions, habits, distribution, and control methods are given in brief for each of the 30 most troublesome weeds in the State.

HORTICULTURE.

Tomato fertilizer test (*Georgia Coastal Plain Sta. Bul.* 2 (1922), pp. 25, 26).—A tabulation of computed acre yields of 12 plats of Ponderosa tomatoes to which various combinations of fertilizer were applied at the rate of 1,000 lbs. per acre showed the largest yield, 4,617.2 lbs., from the use of a formula consisting of 2 per cent of ammonia, 12 per cent of acid phosphate, and 8 per cent of potash. In comparing the effect of 800, 1,000, 1,200, and 1,400 lbs. of a 4-8-10 fertilizer on the Stone tomato, the largest yield, 9,232.4 lbs., was obtained from the largest amount of fertilizer. However, the increase above the 1,200-lb. plat was practically insignificant.

Effect of time of application of nitrogenous fertilizers on tree growth, bloom, and fruit production. G. S. RALSTON (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 118-123).—Observations on the response of apple trees of relatively low vigor to nitrate of soda applied in moderate quantities to comparable plats of trees at monthly intervals beginning March 1 and ending August 1, indicated that the time of application is an important factor, the earlier applications in general being much more effective in relation to growth and yield.

The total amount, length and diameter, of shoot growth was particularly influenced by the March, April, and May applications. The leaves of the early treated trees were found to be larger and of a more intense green than those of the trees receiving later applications. Although the early treatments had the greater effect on length of spur growth, some influence was recorded as late as June 1.

The repetition of the treatment in subsequent years on the same trees has tended to force many spurs into active growth. However, this increased activity did not result in decreased production, in that new spurs were formed on the new wood and the old spurs were strengthened.

The time of maturity, or rather the time when elongation of vegetative parts ceased, was not materially affected by the time of application of nitrogen. Fruit production was increased slightly at the time of the initial treatment, especially following the early applications, and the repeated use of nitrogen led to material increases in yield. It is recommended that treatments should be applied at the time the buds commence to enlarge in the spring and not in accordance with the calendar.

Nitrogen reserve in apple trees, R. H. ROBERTS (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 143-145).—Chemical analysis of the new growth of pot-grown dwarf Wealthy apple trees, part of which had been subjected to high nitrogen and part to low nitrogen nutrition the preceding year (1920), indicated that apple trees are able to build up and utilize a nitrogen reserve. Four groups of trees separated according to nutrition treatment as follows: (1) High nitrogen in 1920 and 1921, (2) high nitrogen in 1920 and none in 1921, (3) low nitrogen in 1920 and high in 1921, and (4) low nitrogen in 1920 and none in 1921, made, in the order given, average growths in 1921 of 137.4, 126.6, 92.3, and 52.2 cm. and contained 0.99, 0.99, 0.66, and 0.66 per cent of nitrogen in the new growth at the beginning of the season, and 0.90, 0.32, 0.94, and 0.29 per cent of nitrogen in similar growth collected after harvest. The trees in group 2 made nearly as much growth as those in group 1, but in so doing their nitrogen content was reduced by two-thirds. The trees in group 3 showed extraordinary recovery, making a good growth and gaining 40 per cent in nitrogen content. In connection with a table giving percentages of starch, total sugar, and total nitrogen in branches at the cessation of terminal growth in 1921, it is shown that blossom bud formation occurred abundantly only in those trees which had an intermediate percentage of nitrogen and the reciprocal condition of an intermediate percentage of carbohydrate reserves.

Factors which influence the production and growth of fruit buds on the apple, T. J. MANEY and H. H. PLAGGE (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 100-103).—Measurements, given in tabular form, of the yield and increase in growth (circumference and twigs) on Jonathan and Northwestern Greening trees growing in a Missouri loess soil under four different systems of soil management, (1) clover sod, (2) clean cultivation with cover crop, (3) clean cultivation, and (4) blue-grass sod, showed a definite correlation between growth and yield of fruit. The characteristic appearance of the terminal growth on blue-grass sod trees, invariably devoid of leaves except for a terminal whorl, is considered by the authors to be a valuable indication of poor nutritional conditions. Records of the number of spurs removed inadvertently in the process of picking showed 40 per cent for Eastman, 31 per cent for Patten Greening, and 43 per cent for Northwestern Greening, of the total fruits harvested. A count of the total number of spurs on three Jonathan trees, two in cover crop plats and one in blue grass sod, showed 15,900 and 15,800 spurs

for the cover crop trees and 12,631 spurs for the blue grass tree. It is estimated that trees in blue grass possessed sufficient spurs to bear from 50 to 75 bu. of apple, yet records showed a production of only from 5 to 6 bu.

Data obtained on 18-year-old Malinda trees fruiting in 1921 indicated a strong correlation between length of spur and productivity. Of the total fruit produced, 53.38 per cent was borne on spurs 5 to 25 mm. in length, 27.3 per cent on spurs 25 to 50 mm., 18.96 per cent on spurs 50 mm. and above, and only 0.35 per cent on spurs under 5 mm. Records of the number of fruit spurs above 5 mm. in length on Roman Stem apple trees growing in clover sod, blue grass sod, and clover cover crop plats, treated three weeks previous to bloom with applications of nitrate of soda at the rate of 6 and 12 lbs. showed a marked response to nitrogen. Records of the percentage of spurs above 5 mm. length on Wealthy trees growing in a mixed clover sod and subjected to similar nitration treatment, showed a similar lengthening in response to nitrogen. The lesser length of spurs on Jonathan and Northwestern Greening trees growing in blue grass than those of similar trees in clean culture is believed to be indicative of the effect of cultural practices on spur development.

Records of the comparative production, terminal growth, and circumference of the trunk of interior and outer trees in a 5-row block of 30-year-old Northwestern Greenings planted 28 by 28 ft. showed that during the period 1912-1920 the exterior trees greatly outyielded the interior and surpassed them in growth increment. Measurements of terminal growth on the inside and outside of the exterior trees showed a much more vigorous development on the exposed portion, leading the authors to believe that sunlight is a potent factor in influencing the development of apple trees.

Inheritance of foliar glands of the peach, C. H. CONNORS (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 20-26).—Observations made at the New Jersey Experiment Stations upon the shape, number, and character of glands of the leaves of a large number of peach varieties and seedlings of known parentage have not revealed a single instance of the presence of two types of glands on a single leaf or even upon the leaves of a single tree. The number, position, and size of glands was, however, exceedingly variable, in apparent response to the conditions of growth.

Of three types of leaves under observation, namely, those without glands, those with globose, and those with reniform glands, the last were much more numerous in the material studied. A correlation was noted between the type of gland and the character of the margin, reniform glands being correlated with crenate, and globose glands with serrate-crenate margins. With two exceptions, in which accidental mixtures may have occurred, reniform glanded varieties, when either selfed or intercrossed, yielded reniform glanded seedlings. The selfing of Early Crawford, a globose glanded variety, yielded 37 globose, 27 reniform, and 20 glandless leaved seedlings. Reniform \times globose and the reciprocal combination yielded seedlings in the approximate ratio of 1:1 in respect to glands. Glandless seedlings resulted only from the selfing of globose glanded varieties. No correlation was found between size of bloom and shape of gland.

The fact that many peach varieties perpetuate themselves quite true from seed, producing seedlings nearly like the parent, is believed to have led to the mistaken supposition of the existence of different types of glands on trees of a single variety.

The effects of certain soil treatments on the formation of fruit buds in peaches, B. S. PICKETT (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 80-82).—A further report (*E. S. R.*, 47, p. 830) upon studies under way at Olney, Ill., relating to the nutrition of the peach.

As determined by estimates in the spring of 1921, clean culture unassisted by fertilizers produced 300 per cent more blossoms than did a cowpea cover crop unassisted by fertilizers other than lime and rock phosphate. Sodium nitrate, used alone, increased the amount of bloom in clean cultivated plats 26 per cent and in cowpea plats 15 per cent. Potassium sulphate increased the amount of bloom in clean cultivated plats by 37 per cent and in cowpea plats by 330 per cent. Muriate of potash was equally as effective as sulphate of potash in influencing yield. The application of rock phosphate to clean cultivated plats resulted in a 9 per cent increase in bloom, as compared with 17 per cent for acid phosphate and 34 per cent for Thomas phosphate. Stable manure added to clean cultivation increased blooms by 23 per cent. The same material applied to cowpea plats increased the bloom 300 per cent. The addition of nitrate of soda to clean cultivated potassium sulphate plats resulted in an increase of 46 per cent of blossoms, but on cowpea plats there was no increase. On the other hand, the addition of potassium sulphate to clean cultivated nitrate of soda plats increased the blossoms by 34 per cent, and increased the blossoms in the cowpea plats by 261 per cent. The most profitable yield of fruit (as indicated by estimate of blossoms) occurred on the clean cultivated plats fertilized with nitrate of soda and potassium sulphate.

The effect of certain potassium and nitrogen fertilizers on the shoot growth and flower formation of the peach, W. A. RUTH (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 152-160) —In connection with data reported in the above paper, measurements were taken of the 1920 and 1921 growth on typical trees in various plats in the cultivated area. Trees receiving the following treatments were included in the study: (1) Nitrate of soda 0.75 lb., (2) nitrate of soda 0.75 lb. and potassium sulphate 0.5 lb., (3) nitrate of soda 6 lbs., (4) nitrate of soda 6 lbs. and potassium sulphate 4 lbs., and (5) no fertilizer. All the new growth in the southwest portion of each tree was recorded and the records arranged in groups according to the length of shoots.

It was found that the shoots on trees receiving nitrate of soda alone were considerably larger at the base and at both leaf and flower buds than were those of the control tree. The diameters of the shoots of the trees receiving potassium sulphate in addition to nitrate of soda were, irrespective of the amount of the application, notably less than those of the tree receiving nitrate alone. The average diameter of shoots was less at the flower than at the leaf buds, irrespective of treatment.

Observations on the frequency of flowers on shoots of various lengths showed that although shoots up to 1 cm. in length bore almost no flowers, those between 1 and 5 cm. bore the greatest number of flowers per unit length. The trees receiving 0.75 lb. of nitrate of soda produced approximately the same number of blossoms as the control tree. Floral productivity on the other three trees was much above that of the control tree.

In recording, in the fall of 1921, the diameters of all current shoots between 10 and 15 cm. length on four trees, two control and two potassium sulphate plus nitrate of soda, it was found that the average diameter of the fertilized trees was slightly less than that of the control. Other data taken on check trees and on trees heavily fertilized with nitrate of soda, nitrate of soda and potassium sulphate, and potassium sulphate alone, indicated that trees receiving potassium sulphate and nitrate of soda were behaving similarly to those treated with nitrate alone. The total number of shoots on the check trees was much higher than that of trees receiving nitrogen alone or in combination with potassium sulphate. However, the check shoots were shorter, a relatively high percentage falling below 1 cm. The number of shoots between 1 and 5 cm.

was low on the check trees, and above 5 cm. the distribution was much the same in the check as in the nitrated trees. Those trees receiving potassium sulphate alone contained a much smaller number of shoots, with distribution in length classes similar to that of the other trees.

In general conclusion, it is pointed out that the differences in the amount of bloom on the various plats were not attributable to any extent to a greater number or increased length of shoots, but rather to increased productivity in shoots of length greater than 1 cm. Potassium sulphate apparently affected the diameter of shoots. Shoots below 1 cm. were found unproductive, and of those above 1 cm. the shorter were the more productive.

Effect of an early application of nitrogen on peach trees deficient in vigor. M. A. BLAKE (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 139-143).—The early spring application of nitrate of soda to 7-year-old Elberta peach trees in an unthrifty condition resulted in greatly increased yields of larger and better appearing fruits. The nitrated trees set a much higher percentage of blooms and lost much less fruit during the June and subsequent drops than did the control trees. The leaves of the treated trees were dark green, and although the fruit ripened later than that of the check trees it was much larger in size, ranging from about 8 to 8.25 in. in circumference, as compared with about 7 in. for the fruits of the control trees.

The tabulated yields, given in units of 16-qt. baskets, show that the untreated trees produced 642.6 baskets and the nitrated trees 1,212.6 baskets per acre of 180 trees, and because of the better quality of the fruit from the fertilized trees, the profit from nitration was considerably more than indicated by the number of baskets of fruit. The author, however, cautions that nitrogen applied to young vigorous trees may delay fruiting and cause dropping of fruits in trees 3 and 4 years of age.

Lime studies with hydrangeas. C. H. CONNORS (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 135-138).—The occurrence in the establishment of a practical grower of severe injury to *Hydrangea (hortensis) opuloides* plants following the addition of a large quantity of hydrated lime to the potting soil led to the initiation of an experiment at the New Jersey Experiment Stations in the summer of 1921 to determine the effect upon the vegetative development of hydrangea plants of adding various forms and amounts of lime.

Of the four forms of lime (1) slaked magnesian lime containing 47 per cent of CaO and 32 per cent MgO, (2) slaked calcium lime containing about 60 per cent CaO and 2 per cent MgO, (3) ground magnesian limestone containing about 30 per cent CaO and 20 per cent MgO, and (4) ground calcium limestone of low magnesium content, used in the test, the two limestones caused no injury even when applied at the rate of 10,000 lbs. per acre. The 1,000-lb. applications of slaked materials were used safely, but the larger applications, 2,000, 4,000, and 10,000 lbs., caused the plants to become chlorotic, the largest amount practically inhibiting growth. The excessive amounts of lime had no material effect upon the H-ion concentration of the soil. Magnesium had an apparent toxic influence when present in large amounts.

Considerable variation in vigor in relation to variety was noted, the *Trophée* and *Eclairer* being weak growers, while E. G. Hill, *Souv. de Mme. E. Chautard*, and *Mme. Auguste Nonin* were vigorous.

FORESTRY.

Results of a test planting of Scotch pines from various sources. M. KIENITZ (*Ztschr. Forst u. Jagdw.*, 54 (1922), No. 2, pp. 65-93, figs. 2).—A report is given on the behavior of several lots of Scotch pine planted at Chorin in

1906-07 and 1907-08 in compliance with an agreement perfected at the International Conference of Forest Experiment Stations at Stuttgart in 1906, wherein seed collected in different countries was to be assembled and divided for testing at experiment stations in several localities. Material was obtained in Scotland, France, East Prussia, Belgium, Bavaria, Courland, Brandenburg, and Russia in 1906-07 and in Bulgaria, Sweden, and north and west Hungary in 1907-08. Data relative to latitude, longitude, elevation, and the character of the soil in which the parent trees were growing were carefully recorded.

All the eight lots planted at Chorin in April, 1907, in a selected soil rich in humus and mineral nutrients germinated simultaneously. In the first season differences were detected between the lots in respect to height, length and color of needles, and the time of cessation of growth. The Ural-Russian lot completed growth on August 23 and the Courland lot on September 23, while the lots from France, Scotland, and Belgium did not cease growth until heavy frosts occurred in November. The lots from southern France and the Ural region were especially bright green in color. In winter the Ural seedlings became brownish violet, the French and Scottish lots retained their summer color, while the remaining lots took on a yellower hue. Peculiar variations were noted in the time of renewing growth in the spring of 1908, the Ural lot growing vigorously, the Courland, East Prussia, and southern France lots less vigorously, and the others barely starting on April 10. Measurements taken in the spring of 1908 showed a range in average root length of from 224 mm. for the Ural to 315 mm. for the Belgian lot, with a total weight ranging from 6 gm. for the Scottish to 23 gm. for the Rhine Palatinate lot. A direct correlation was observed between weight of plant and the development of shoots.

A very uniform piece of land was selected as a permanent site for the seedlings, and, in addition, small lots of each strain were planted in the forest garden for daily observation. The measurements of total height taken in the fall of 1907, 1908, 1909, 1910, 1912, and 1919 show that the seedlings from the Rhine Palatinate maintained supremacy during the first four years, yielding first position to the Brandenburg lot in 1912. In 1919 the East Prussian lot had assumed the lead, the height records being as follows: East Prussia 301 cm., Brandenburg 295, Belgium 254, Rhine Palatinate 220, Courland 195, Ural 174, Scotland 161, and France 150 cm.

The data obtained in the study, though not final, are believed to show a very marked effect of the place of origin of seed on the behavior of Scotch pine trees, thereby confirming a popular opinion that care should be taken to obtain seed from an approved source.

Longleaf pine. W. R. MATTOON (*U. S. Dept. Agr. Bul. 1061 (1922), pp. 50, pls. 22, figs. 6*).—In this illustrated paper on the longleaf pine (*Pinus palustris*), a species which on account of rapid growth, yield of valuable timber and naval stores, and adaptation to the low, wet Coastal Plains is of immense value in the Southern States, information of a general nature is presented relative to the rate of growth, uses and value, production of timber and resin, methods of cutting and reforestation, and protection. Emphasis is placed on the rapid diminution of the original virgin forests and the need of protecting the young stands from hogs, fire, and unreasonable resin exploitation. It is pointed out that vast areas of idle nonagricultural land now exist which could be profitably utilized in the production of timber and naval stores.

Utilization of basswood. W. D. BRUSH (*U. S. Dept. Agr. Bul. 1007 (1922), pp. 64, pls. 8, figs. 7*).—Two species, *Tilia americana* and *T. heterophylla*, supply the basswood of commerce, which, on account of the white color, light weight,

and good working qualities, is highly valued in the woodworking industry. In this paper the author, after considering the physical, mechanical, and anatomical properties of the wood, the source of supply, rate of use, and necessity of planting, presents information relative to the commercial utilization of basswood. Data are presented in tabular and graphical form relative to the principal manufacturing localities, production by States, stumpage, mill and market values, and consumption in the form of veneer, excelsior, pulpwood, and miscellaneous secondary industries. The grades of raw lumber are briefly discussed, and information is presented relative to those articles of manufacture for which basswood is exceptionally well adapted. A classified list of uses reported by factories is appended.

A note on Casuarina plantations in the Vizagapatam district, G. JOGIRAJU (*Madras Dept. Agr. Bul.* 82 (1921), pp. 19, figs. 2).—A brief article of general information in which are presented data relative to nursery practices, planting, rate of growth, economic uses, costs of growing, etc.

Forest planting, E. SECREST (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 9-10, pp. 144-151).—Suggestions are presented relating to raising forest nursery stock, selecting planting sites, season of planting, spacing, methods of planting, and care of young trees. A planting chart giving this information in detail for 21 species of trees is included.

Progress report of forest administration in Baluchistan for 1920-21, M. AFZAL (*Baluchistan Forest Admin. Rpt.*, 1920-21, pp. [26]).—Similar to that of the preceding year (*E. S. R.*, 46, p. 238), this report contains information concerning alterations in area of the forests, protective activities, revenues, expenditures, etc.

Reports on the forest administration of the Bombay Presidency, including Sind, for the years 1919-20 and 1920-21 (*Bombay Forest Admin. Rpts.* 1919-20, pp. 129+2; 1920-21, pp. 127+3).—These are the usual annual reports (*E. S. R.*, 43, p. 748), containing information relative to the alterations in area of the State forests, protective measures, silvicultural operations, and general administrative activities, with revenues and expenditures presented in tabular form.

Annual reports on the forestry department [from April 1, 1918, to December 31, 1920], R. FYFE and R. A. GIBSON (*Uganda Forestry Dept. Ann. Rpts.*, 1918-19, pp. 11; 1919-20, pp. 7; 1920, pp. 13).—These are the usual progress reports for the two years ended March 31, 1920, and for the period from April 1 to December 31, 1920 (*E. S. R.*, 40, p. 343), relating to changes in personnel, planting activities, silvicultural operations, revenues, expenditures, etc. The report for the period April 1 to December 31, 1920, contains a statement relative to the forest resources of Uganda, prepared for the British Empire Forestry Conference held in London in 1920.

DISEASES OF PLANTS.

An introduction to bacterial diseases of plants, E. F. SMITH (*Philadelphia and London: W. B. Saunders Co.*, 1920, pp. XXX+688, pl. 1, figs. 453; rev. in *Phytopathology*, 11 (1921), No. 2, p. 107).—The subject matter of this book is arranged in five parts. The first presents a conspectus of bacterial diseases of plants, dealing with host range, susceptibility, infection factors, incubation, recovery, agents of transmission, host reactions, and other aspects of the science. The second deals with such matters as methods of research, apparatus, culture media, and technique of isolation. The third gives a synopsis of selected diseases in which the type, cause, technique, and literature of 14 bacterial diseases are given, and for each disease so treated a laboratory

outline in the form of questions and suggestions is presented. The fourth is somewhat miscellaneous, containing notes on additional diseases, suggestions for special study, the production of tumors in the absence of parasites, speculations on the chemical and physical stimuli underlying tumor formation, and the production of teratosis in the absence of tumors and of parasites. The fifth contains observations on experimentation, interpretation, ethics of research, and similar matters.

A new species of *Exobasidium*, J. W. HOTSON (*Phytopathology*, 11 (1921), No. 2, p. 106).—This fungus attacks the young branches of *Vaccinium parvifolium*, apparently gaining access by some wound. The results of attack are described.

Some new hosts for the *Rhizoctonia* disease, F. D. HEARD (*Phytopathology*, 11 (1921), No. 2, p. 105).—The *Rhizoctonia* disease has been found in Klickitat County, Wash., in serious form on young onions in a field previously planted to potatoes. Numerous cases of the disease on strawberries from various parts of Washington have been studied.

Two new species of *Sclerotinia*, B. F. DANA (*Phytopathology*, 11 (1921), No. 2, p. 106).—The chokecherry in the Palouse country is attacked by the disease, causing a leaf, twig, and fruit blight. The fungus causing this disease is a typical *Sclerotinia* with the Monilia or parasitic stage on leaves and twigs, and the *Sclerotinia* or saprophytic stage on the fallen overwintered fruits. The causal fungus is a new species, *S. demissa*. Another *Sclerotinia* disease has been observed and studied as causing a leaf and fruit blight on *Amelanchier cuneifolia*. The causal fungus has been assigned to a new species, *S. gregaria*.

Bordeaux mixture.—II. Stimulatory action, O. BUTLER (*New Hampshire Sta. Tech. Bul.* 21 (1922), pp. 3-50).—In continuation of studies on Bordeaux mixture (U. S. R., 31, p. 802), the author gives the results of investigations on the effect of the composition of Bordeaux mixture on dry matter formed and the transpiration of treated plants, and on the effects produced by spraying.

Various plants were sprayed with a 1 per cent Bordeaux mixture in which the ratio of copper sulphate to lime was 1:1, a 1 per cent mixture in which milk of lime was added to copper sulphate solution until an alkaline reaction was obtained, and a milk of lime containing 1.32 per cent calcium hydroxid.

The experiments indicated that the action of Bordeaux mixture on plants is one of shade in the sense of opaqueness to the spectrum as a whole. The magnitude of the physiological response produced by a Bordeaux mixture on plants depends upon the degree of opaqueness of the wash to the spectrum as a whole. The composition of Bordeaux mixture was found to have a marked effect on the response of the sprayed plant. A Bordeaux mixture that was transparent to the spectrum permitted the plants to grow in all respects like nonsprayed ones, but milk of lime and opaque Bordeaux mixtures caused a decrease in dry matter formed and increased transpiration. Bordeaux mixtures and milk of lime were found opaque to radiations of long wave length. Therefore, under conditions favorable for radiation, sprayed plants cooled less rapidly than nonsprayed ones and consequently transpired more freely.

The author draws certain practical conclusions from his investigations, in which it appears that when shading is injurious to plants that have to be sprayed a Bordeaux mixture containing only a small amount of lime should be used. Mixtures containing a very small amount of lime are less adhesive than those containing a larger proportion. The author suggests that a Bordeaux mixture 1:0.5, being more adhesive than mixtures containing either larger or smaller amounts of lime, should be given preference when shading is objectionable. When shading is considered desirable a 1:1 Bordeaux mixture should

be employed if protection from parasites is required, or a milk of lime may be used whenever a substance without fungicidal properties is to be used.

The rôle of copper in basic Bordeaux mixture, G. VILLEDIEU (*Prog. Agr. et Vitic. (Ed. l'Est-Centre)*, 42 (1921), No. 13, pp. 301-303).—Studies by the author on the rôle of copper in fungicidal sprays have generally been limited to decidedly alkaline Bordeaux obtained by adding the requisite proportion of milk of lime to copper sulphate of supposedly fungicidal strength, as most generally employed in viticultural regions under his observation.

The development of *Phytophthora infestans*, said to be comparable with that of grape downy mildew, has been studied as taking place on the under side of the leaf in a suspended drop of water over a dish kept moist by maintaining a little water in the bottom. It is said to be easy to see that the liability to injury and the sensitivity of the spores to toxic substances have been greatly overrated.

Conidia introduced into a drop of copper sulphate solution of strength 1:100,000 germinate. The zoospores liberated move about in the solution for 20 to 30 minutes, and fix and germinate exactly as in distilled water. These changes occur also in the same strength of copper citrate.

Bordeaux mixture when dried on the leaf contains, along with the lime (often met with abundantly as carbonate), cupric residues composed of basic sulphates of copper and copper hydrocarbonate, lime sulphur arising from the reaction of copper sulphate on lime, and lime in excess.

Methods are outlined to be employed in studying spore germination, so that the process will be directly visible.

Formulas are recommended, employing for the first 1 per cent aluminum sulphate with 5 per cent finely pulverized lime; for the second (which is preferred) 1.5 and 7.5 per cent of these components, respectively, in aqueous solution.

Acetaldehyde as a fungicide (*Canada Expt. Farms, Div. Bot. Interim Rpt.*, 1921, pp. 18-20).—Of the three experiments here noted, the first two were carried out at Ottawa by F. L. Drayton, and the third at Indian Head under W. P. Fraser. The germicidal value of acetaldehyde, as determined at McGill University, was found to correspond at a dilution of 1:5 to a 1:100 carbolic acid solution. The general conclusion reached from the data as tabulated and discussed is that the fungicidal and germicidal value of acetaldehyde is too low to be of any commercial value.

Report of Dominion Field Laboratory of Plant Pathology, Fredericton, N. B., G. C. CUNNINGHAM (*Canada Expt. Farms, Div. Bot. Interim Rpt.*, 1921, pp. 57-67).—The potato work reported includes late blight spraying demonstration results, showing an average increase (10 tests) of over 80 bu. per acre; and results from mosaic roguing and selection tests, showing 25½ per cent inferiors from stock apparently healthy as against 98½ per cent inferiors from known mosaic stock.

Study on a rot of turnip stecklings showed the relation of the rot to storing conditions but not to any organism.

Report of the Dominion Field Laboratory, Charlottetown, P. E. I., J. B. McCURRY (*Canada Expt. Farms, Div. Bot. Interim Rpt.*, 1921, pp. 22-56, figs. 16).—In this report are summarized the results of experiments conducted in 1915-1920 under P. A. Murphy, with later additions.

Attention was given principally to diseases attacking potato, turnip, and apple, and secondarily to those attacking cherry, wheat, bean, begonia, sweet pea, aster, and tomato. The major features of the work and results therefrom are indicated in descriptive and tabular detail with discussion.

[**Plant diseases, India**], S. L. AJREKAR (*Bombay Dept. Agr. Ann. Rpt.*, 1918-19, p. 90).—Continued study of potato storage rots is said to have produced the organisms supposed to cause the diseases black rot (*Rhizoctonia solani*) and dry rot. Potato tambara disease, so-called, appears to be caused by a mite.

Mulze is infected with *Sclerospora maydis*, supposedly through the seed. Preliminary spraying experiments against powdery mildew on *Cuminum cuminum* indicated the possibility of checking this disease by spraying the crop, when one and one-half months old, with normal Bordeaux mixture.

Corn root rot (*Kentucky Sta. Rpt.* 1921, pt. 1, p. 41).—A study of the relative resistance of corn to root rot was made by comparing seedlings grown from different ears in a sand box. The dates of the death of the seedlings were taken to indicate their relative resistance to *Fusarium moniliforme*. From plantings made in the field of selected ears which showed the smallest amount of infection, comparisons revealed that no increase in yield was obtained over smaller plantings from susceptible ears.

Ustilago crameri on *Setaria italica*, S. SUNDARARAMAN (*Agr. Research Inst., Pusa, Bul.* 97 (1920), pp. 11, pls. 3; *abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr.*, 12 (1921), No. 7, p. 924).—Indian millet (*S. italica*), present in all the districts of the Madras Presidency except Malabar and South Kanara, and valuable as food crop, is subject to attack by certain fungi causing much loss, the green-ear disease *Sclerospora graminicola*, rust (*Uromyces setariae italicae*), and smut (*Ustilago crameri*) being of the first order of importance, and the last-named ranking easily first as to amount of loss, which in this case is due to the destruction of the stored starch by the fungus.

The spores germinate freely in distilled water, but fail to germinate when placed in copper sulphate of 0.5 per cent and higher concentration for 15 to 30 minutes. Steeping seed of *S. italica* in 5 per cent copper sulphate for 30 minutes or in higher concentration for shorter periods reduces germination.

The smut enters the plant in the young seedling stage. The spores do not infect the flowers.

Report of the barberry and the black rust of wheat survey in Southwest Wales, W. H. BROADBENT (*Jour. Min. Agr. [London]*, 28 (1921), No. 2, pp. 117-123, pl. 1).—During the previous two years several cases of wheat black rust (*Puccinia graminis*) were reported from southwest Wales, and investigations were instituted, the results of which are embodied in this report.

It was found that barberry was widely and plentifully distributed, the cluster-cup stage of the black rust fungus being abundant in spring and early summer. Black rust shows much the same distribution, causing serious loss each year. These diseases are reducing the yield, profits, and acreage in wheat.

Common diseases of beans and peas, M. T. COOK (*New Jersey Stat. Circ.* 142 (1922), pp. 8, figs. 5).—A popular description is given of diseases to which beans and peas are subject, this circular being intended to replace Circular 84 of the stations (E. S. R., 38, p. 48).

Hop mold and its control, E. S. SALMON (*Jour. Min. Agr. [London]*, 28 (1921), Nos. 2, pp. 150-157, pls. 5; 3, pp. 260-263).—The first section of this article deals descriptively with the life history of hop mold or mildew (*Sphaerotheca humuli*), the damage caused thereby, and preventive measures. The second deals with indirect control measures which are indicated.

Lettuce investigations (*Kentucky Sta. Rpt.* 1921, pt. 1, pp. 44, 45).—Studies are reported on the failure of lettuce to head, and the results indicate marked differences in the various strains in extent of heading. Plants were grown

in steam-sterilized soil, soil sterilized with formaldehyde, and baked soil to which nutrient solutions were applied, but they showed a considerable amount of root rot and developed tipburn. Further studies are reported in which lettuce was grown in soil sterilized with formaldehyde, and the treatment was found to have a definite influence on the factors which caused failure to head. Tipburn and other physiological disturbances were also delayed by the soil treatments. It is believed that the cause of the root rot and the associated disease, tipburn, is a seed-borne organism which apparently is not present in virgin soil, but which may be present in garden soils and refuse.

A condition similar to the lettuce disease was noted in Chinese cabbage grown in the greenhouse during 1920-21.

Mosaic disease of potatoes (*Kentucky Sta. Rpt. 1921, pt. 1, p. 45*).—In an attempt to eliminate the mosaic disease from diseased strains of potatoes, cuttings made from individual tubers were planted in the spring, and the remainder of the tubers were placed in cold storage and kept for planting in the fall for the production of seed stock. Records maintained from the plants in the field made it possible to eliminate the corresponding seed pieces held in cold storage. The remnants from the healthy tubers were planted July 26 and showed no signs of mosaic throughout their growth period. It is believed that this method, with possibly some modification, may prove a means of securing disease-free seed stock.

Potato pink rot: A disease new to England, A. D. COTTON (*Jour. Min. Agr. [London]*, 28 (1922), No. 12, pp. 1126-1130).—In the summer of 1921, potato pink rot (*Phytophthora erythroseptica*) was discovered at two centers in England, having been found previously in Scotland. An account is given of the outbreaks, with a description of the disease and protective measures found effective.

Potatoes.—Varieties immune from black scab or wart disease (*Ireland Dept. Agr. and Tech. Instr. Jour.*, 21 (1921), No. 1, pp. 108-112).—Tabular data and a discussion are presented regarding variety tests for immunity to wart disease and desirability in other respects of numerous potato varieties.

Diseases of the swede crop in Cumberland and Westmoreland in 1921, R. B. STRANG (*Jour. Min. Agr. [London]*, 28 (1922), No. 12, pp. 1093-1096).—Powdery mildew was one of the most prevalent diseases of swedes throughout the country in 1920. Clubroot was generally prevalent. Wet rot (*Bacillus carotovorus*) is suspected in case of extensive breaking due to rain following long drought.

Wildfire and angular spot, F. D. FROMME (*Rhodesia Agr. Jour.*, 18 (1921), No. 4, pp. 411-414).—An introductory note by H. W. Taylor states that both of these tobacco diseases occur in Rhodesia, having been introduced there supposedly through the use of tobacco seed from the United States. Angular leaf spot was very prevalent and injurious to tobacco interests during the two seasons preceding this report. Free treatment of tobacco seed and subsequent trial thereof had been provided for in Southern Rhodesia.

A Cytospora canker of apple and another "die-back" fungus of interest, S. M. ZELLER (*Phytopathology*, 11 (1921), No. 2, p. 105).—An apple canker due to a *Cytospora* said to be identical with that described by Stevens (*E. S. R.*, 41, p. 156) occurs in various parts of Oregon, infecting trees which are devitalized. *Cyphella marginata*, previously reported on peach in Australia only, occurs on twigs of peach and almond in Benton and Douglas Counties, Oreg.

Internal browning of the Yellow Newtown apple, W. S. BALLARD, J. R. MAGNESS, and L. A. HAWKINS (*U. S. Dept. Agr. Bul. 1104* (1922), pp. 24, pls. 2).—It has been recognized that certain apples grown under particular

climatic conditions and held in cold storage at temperatures around 32° F. are liable to develop a browning of the tissues of the fruit. This is said to be especially true of Yellow Newtown apples grown in the Pajaro Valley, an important apple district of California, where there is a cool growing season coupled with high humidity and very fertile soil.

Studies are reported which show that a number of factors contribute to the internal browning of the fruit in storage, and that it is not caused by a parasitic organism. It was found that in seasons of high crop production the fruit has been practically free from internal browning. Heavy fertilization with manure is said to increase the percentage of browning, and heavy nitrogen fertilization increased it markedly in all trees except those bearing a very heavy crop. The conditions in the Pajaro Valley are said to favor internal browning of the fruit in storage when light crops of large, coarse-textured fruit are produced. As the soil and climate can not be controlled, attention should be paid to storage conditions especially during the years when light crops of large fruit are produced. Internal browning of such fruit was found to develop to a far greater extent when apples were stored at 32° than when kept at from 36 to 40°. In commercial practice it is recommended that apples in this valley should be stored at temperatures of from 36 to 38°.

Moldy core of the Stayman Winesap, F. D. HEALD (*Phytopathology*, 11 (1921), No. 2, p. 105).—A study was made of the fungi found in the core cavities of Stayman Winesap apples in storage at intervals of two weeks during the winter period. Practically all apples with an open calyx canal showed a slight or very evident growth of mold in the core. The forms isolated included two species of *Penicillium*, two of *Alternaria*, two of *Cladosporium*, and *Hypoclinus*, and several species which failed to fruit in cultures. All except the species of *Penicillium* and *Alternaria* failed to cause a rot in sound apples. The conclusion is drawn that the presence of mold in the cores of Stayman Winesaps is no indicator of their keeping qualities, the species present being the important factor.

A spur blight of pear caused by Botrytis, S. M. ZELLER (*Phytopathology*, 11 (1921), No. 2, p. 105).—During April and May specimens of blighted spurs of d'Anjou pear were sent in from two localities in Douglas County, Oreg. The organism isolated from these spurs belongs to the cinerea group of *Botrytis*.

From 10 to 15 per cent of the spurs were damaged, and some injury is reported on Winter Nells and Comice pears.

Heart rot of prune and peach in Oregon, S. M. ZELLER (*Phytopathology*, 11 (1921), No. 2, p. 105).—Many orchards of these stone fruits have been examined for heart rots, and it has been found that in western Oregon a greater percentage of the existing wood decay in prune and peach trees is due to the pink-bracket fungus (*Trametes carnea*) than to all other fungi together. The large pruning wounds are the most common place of infection. Heart rots of peach and prune are frequently caused by *Lenzites saepiaria* and *Fomes pinicola*, which are also usually found on coniferous hosts.

The nature of court-noué, A. GAUCH and J. DURAND (*Prog. Agr. et Vitic. (Ed. l'Est-Centre)*, 41 (1920), No. 23, pp. 540-543).—Facts and views credited to different authors are discussed with emphasis on the suggestion, based partly on analogies which are indicated, that court-noué is an avitaminosis, or disease due to depletion or absence of essentials at least analogous to vitamins in animals.

Court-noué and vitamins, C. LEFÈVRE (*Prog. Agr. et Vitic. (Ed. l'Est-Centre)*, 41 (1920), No. 25, pp. 587, 588).—This discussion deals with the bearings of the vegetable vitamin hypothesis set forth in the contribution by Gauch and Durand above noted.

The nontoxicity of copper, MR. and MRS. G. VILLEDIEU (*Prog. Agr. et Vitic. (Ed. l'Est-Centre)*, 41 (1920), No. 47, pp. 498-500).—In a discussion of the alleged nontoxicity of copper compounds for fungi in general and for downy mildew in particular, the authors claim to show that copper is not more toxic for Peronosporaceae than for other fungi, and that it appears possible to replace this metal with one more easily obtainable in making up anticyptogamic sprays.

Salts of copper toxic to downy mildew, FONZES-DIACON (*Prog. Agr. et Vitic. (Ed. l'Est-Centre)*, 41 (1920), No. 50, pp. 561-564).—The author concludes his reply to the claims made by the Villedieus of nontoxicity as regards copper compounds when used against grape downy mildew by stating that while this may be true as regards copper in the complex form of the ammoniacal citrate, or under some form comparable thereto, this is presumably not true of the forms commonly used in viticulture, as copper sulphate when employed, for example, in Bordeaux or in Burgundy mixture, or as neutral or basic copper acetate.

The nontoxicity of copper for grape downy mildew, MR. and MRS. G. VILLEDIEU (*Prog. Agr. et Vitic. (Ed. l'Est-Centre)*, 42 (1921), No. 11, pp. 259, 260).—This is partly a review of studies previously noted (*E. S. R.*, 45, p. 49) and partly an account of others still in progress, tending to invalidate the views formerly held regarding the toxicity for fungi of copper compounds, and to encourage the use of noncupric fungicides.

Villedieu formulas against grape downy mildew, L. DEGRULLY (*Prog. Agr. et Vitic. (Ed. l'Est-Centre)*, 42 (1921), No. 12, p. 278).—Two formulas for grape downy mildew sprays employ for the first 1 per cent aluminum sulphate with 5 per cent powdered lime, and for the second 1.5 and 7.5 per cent of these respective components. The second is preferred. The lime is said to exert no toxic effect but to hinder mechanically the penetration of the leaf by the fungus.

Grape downy mildew and recent fungicides, P. GERVAIS (*Vie Agr. et Rurale*, 19 (1921), No. 27, pp. 1-4).—A critical discussion, including his own contributions, is offered by the author regarding recent utterances called forth by the claim of Villedieu denying to copper the principal effectiveness in certain standard fungicides.

Mildew sprays [without copper], G. DAUREL (*Prog. Agr. et Vitic. (Ed. l'Est-Centre)*, 42 (1921), No. 51, pp. 592-595).—A comparative review is given of work reported by several authors bearing on the treatment of grape downy mildew with lime and aluminum sulphate.

Grape downy mildew control, A. CADORET (*Prog. Agr. et Vitic. (Ed. l'Est-Centre)*, 43 (1922), No. 5, pp. 113-115).—Observation and experimentation during a number of years are cited as showing that all calculations and protective measures are apt to fail as regards effective control of grape downy mildew in years of exceptionally copious precipitation, among which 1910, 1915, 1916, and 1920 are mentioned. Even as many as 12 sprayings may fail to keep down the disease.

Spore germination in grape downy mildew, L. RAVAZ and G. VERGE (*Prog. Agr. et Vitic. (Ed. l'Est-Centre)*, 43 (1922), No. 1, pp. 10-12).—Sulphuric acid in rain water arrested spore germination in case of *Plasmopara viticola* at a concentration of 1:50,000, and copper sulphate at 1:400,000 to 1:300,000 (corresponding to 1:1,000,000 metallic copper). Calcium sulphate in saturated solution did not arrest germination, and sodium carbonate was effective at between 1:8,000 and 1:7,000. Other particulars are given with discussion. Lime forms carbonate too quickly to be effective as a fungicide. Bordeaux mixture resists for a considerable time removal by rain water or dew, yield-

ing copper in sufficient quantity to inhibit germination of the spores of grape down mildew.

The parasitism of *Stereum hirsutum* and its rôle in wilt of grapevines. L. RIVES (*Prog. Agr. et Vitic. (Ed. l'Est-Centre)*, 42 (1921), No. 35, pp. 600, 601).—*S. hirsutum* is said to attack not only old grapevine wood but also wood newly formed, causing changes which are described, and affecting the physiology of the stock in several ways which sometimes become apparent simultaneously. The destruction of the newly formed wood stops the transportation of water.

Black spot of citrus fruits caused by *Phoma citricarpa*, H. A. LEE (*Philippine Jour. Sci.*, 17 (1920), No. 6, pp. 635-641; *abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr.*, 12 (1921), No. 7, pp. 926, 927).—Black spot of citrus fruits was described by McAlpine from Australia in 1899 (*E. S. R.*, 12, p. 654). The purpose of the present paper is to present data of isolation and reinoculation experiments with *P. citricarpa* and also to record further knowledge as to the distribution of the disease. A description is given of the disease, which has been found, thus far, upon fruits of the sweet orange (*Citrus sinensis*) and the mandarin orange (*C. nobilis*).

The disease is not abundant on fruits in the orchard, but seems to develop in storage and transit. It has been observed at Canton, Hongkong, Swatow, Amoy, and Foochow in China, and specimens which emanated from Shanghai have been intercepted by the plant-quarantine inspectors at Nagasaki. Citrus fruit black spot appears to be a Temperate Zone disease.

The fungus *P. citricarpa* was isolated from black spot lesions and, on inoculation, reproduced the disease in healthy orange fruits. Control punctures remained negative, and positive inoculations yielded the fungus. Repeated inoculations would indicate that *P. citricarpa* is the cause of the black spot lesions.

Cercospora leaf spot of *Averrhoa carambola*, C. G. WELLES (*Philippine Jour. Sci.*, 19 (1921), No. 6, pp. 747-751, pls. 2).—A very serious leaf spot of *A. carambola* has been observed in the experimental orchard of the Philippine College of Agriculture causing, between June 25 (beginning of the rainy season) and July 15, 1921, leaf infection amounting to 100 per cent at the latter date, each leaf having 1 to 10 spots which showed a tendency to drop out or to kill the leaf. This paper presents the results of studies made on the organism, which proves to be a *Cercospora*, apparently new, and is described as *C. averrhoi*.

Control experiments employing Bordeaux mixture (1.8 kg. copper sulphate, 2 kg. stone lime, and 190 liters water) were begun July 13, about the middle of the rainy season. By August 1 the untreated trees were defoliated and had put forth new leaves, which showed no infection up to August 8. The sprayed trees held all leaves that had not been too seriously diseased.

Cercospora leaf spot of coffee, C. G. WELLES (*Philippine Jour. Sci.*, 19 (1921), No. 6, pp. 741-745, pl. 1).—The coffee leaf spot due to *C. coffeicola*, not previously reported from the Philippine Islands, has recently caused rather severe spotting and ultimate defoliation of nursery stock at the College of Agriculture. This paper gives a brief description of the disease and the causal organism as studied locally, with a short account of related work elsewhere.

So far as yet observed, the attack is confined to the leaves of nursery stock of *Coffea buxobensis*, the other species, *C. liberica*, *C. robusta*, *C. congensis*, and *C. conophora*, apparently not being attacked. The source of the disease is not known. It has been controlled by spraying every two weeks with Bordeaux mixture, and complete eradication of the disease appears practicable.

The fungus diseases of the tea leaf, A. C. TUNSTALL and S. C. BOSE (*Indian Tea Assoc., Sci. Dept. Quart. Jour.*, 1920, No. 4, pp. 152-154, pls. 4).—In continuation of the reports previously noted (E. S. R., 42, p. 747; 45, p. 654), a discussion is given of gray blight (*Pestalotzia theae*) and of its treatment, which is the same as that recommended previously for brown blight.

White pine blister rust [Canada], A. W. McCALLUM (*Canada Expt. Farms. Div. Bot. Interim Rpt.*, 1921, pp. 13-16).—White pine blister rust, though not observed in Canada until 1914, was soon after found to be prevalent throughout a large portion of the Niagara peninsula, and in 1917 it was found to be present in 38 of the 42 counties of Ontario. Four control observation areas were established in 1918, and on these *Ribes* was completely destroyed.

It has been shown that under average conditions the dispersal of sporidia is not effective at a greater distance than 200 yds. The three factors determined as effective in the spread of the blister rust organisms and disease are the proximity of cultivated *Ribes*, the number of wild plants of *Ribes* present, and the moistness of the situation.

Chemical wood pulp is attacked by molds, R. J. BLAIR (*Quebec Soc. Protect. Plants, Ann. Rpt.*, 14 (1921-22), pp. 39-41, figs. 3).—The purpose of this short article is to state that wood pulp material has been submitted to the Forest Products Laboratories of Canada, showing a molded condition in sulphate and soda pulps and sulphite pulps, both bleached and unbleached. The early discoloration may lower the price of the pulp out of all proportion to the actual damage caused, and if not checked the discoloration spreads until the pulp may become worthless.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

An investigation of the beaver in Herkimer and Hamilton Counties of the Adirondacks, C. E. JOHNSON (*Roosevelt Wild Life Bul.*, 1 (1922), No. 2, pp. 117-186, pl. 1, figs. 36).—This is a detailed report of studies of the Adirondack beaver, the first part (pp. 122-173) dealing with its status in Herkimer and Hamilton Counties and the second part (pp. 173-184) with its natural history.

Measures for the destruction of rats (*Mauritius Dept. Agr., Gen. Ser., Bul.* 25 (1922), Eng. ed., pp. 18).—This is a compilation of information on methods of rat destruction.

Some Scottish breeding duck: Their arrival and dispersal, E. V. BAXTER and L. J. RINTOUL (*Edinburgh: Oliver & Boyd*, 1922, pp. VII+90).—This work deals with the gadwall, widgeon, shoveler, pintail, pochard, elder, common scoter, goosander, and the red-breasted merganser.

Life histories of North American petrels and pelicans and their allies, A. C. BENT (*U. S. Natl. Mus. Bul.* 121 (1922), pp. XII+343, pls. 69).—This continuation of the work on the life history of North American birds (E. S. R., 46, p. 151) deals with the orders Tubinares and Steganopodes.

Killing, staining, and mounting parasitic nematodes, H. G. MAY (*Amer. Micros. Soc. Trans.*, 41 (1922), No. 2, pp. 103-105).—This is a contribution from the Rhode Island Experiment Station based upon work with *Heterakis papillosa*.

The infection of lice (*Pediculus humanus*) with *Rickettsia prowazeki* by the injection per rectum of the blood platelets of typhus-infected guinea pigs and the reinfection of other guinea pigs from these lice, A. BACOT and J. SÉGAL (*Brit. Jour. Expt. Path.*, 3 (1922), No. 3, pp. 125-132, figs. 14).—"The injection of lice (*P. humanus*) with a concentrated emulsion of platelets obtained by fractional centrifugalizations of the blood of a typhus-

infected guinea pig affords a sure and quick method of obtaining the development of *R. prowazeki* in these insects. The lice thus infected can be used to convey typhus fever to fresh guinea pigs. The parallel development of typhus virus and *R. prowazeki* in successively passaged guinea pigs is demonstrated and also in lice infected from guinea pigs after 23 blood or brain passages."

Cyst-forming protozoa in reindeer and caribou, and a sarcosporidian parasite of the seal (*Phoca richardi*), S. HADWEN (*Jour. Amer. Vet. Med. Assoc.*, 61 (1922), No. 4, pp. 374-382, figs. 8).—Under the name *Fibrocystis tarandi* a sarcosporidian causing cysts in the esophagus and other muscles of the reindeer is described as new. A *Sarcocystis* found in seals (*P. richardi*) is described as new under the name *S. richardi*.

Bibliography of hookworm disease (New York: Rockefeller Found., Internatl. Health Bd., 1922, pp. XXVI+417).—This is a classified bibliography of 5,680 entries.

Use of carbon tetrachlorid for removal of hookworms in human beings, G. G. HAMPTON (*Amer. Jour. Trop. Med.*, 2 (1922), No. 5, pp. 381-387).—This is a preliminary report of investigations conducted, the details of which are presented in tabular form. In tests made in Ceylon, in which carbon tetrachlorid was administered to a series of 14 cases, the dosages ranging from 3 to 10 cc., no unfavorable symptoms were noticed. In tests in which the drug was administered to 20 cases, 90 per cent were cured.

Diffusion of carbon disulphid in soil, W. C. O'KANE (*New Hampshire Sta. Tech. Bul.*, 20 (1922), pp. 36, figs. 21).—This is a report of experiments with carbon disulphid in the soil, carried out during the course of an investigation of the use of various materials for soil-infesting insects, especially root maggots. In the first experiments, made with a view to determining the rapidity with which carbon disulphid diffuses through soils of various textures and the influence that texture has on the direction of diffusion, soil to the depth of 6 in. was placed in glass-walled boxes 6 by 6 by 12 in. Soil of fine, medium, and coarse textures was used, the moisture content being less than 0.3 per cent on subjection to 110° F. for two hours. Five living specimens of the common mound-building ant (*Formica exsectoides*) were placed in each cage and observed through the glass sides or bottoms of the boxes. The doses of carbon disulphid used varied from 1 to 5 dr. The results obtained in the several tests, in the first of which carbon disulphid was applied at the middle of the surface of the soil, in the second at the center of the cube of earth, and in the third the same as in the first but with a square of carpet placed over the soil, are presented in chart form.

It was found that when applied at the surface the ants did not succumb until a 5-dr. dose was used and even survived that dosage in coarse soil. It was observed that ants situated diagonally downward died in a shorter time in coarse soil than in medium or fine soil. When applied at a depth of 3 in. in fine soil all of the ants were killed by a dose of 2 dr., whereas in coarse soil a dose of 4 dr. failed to kill all of the ants in the corresponding cage. When the soil was covered with a square of carpet the insects succumbed to doses of 3 and 4 dr., but not so where the carpet was not used. The efficiency was greater in the application 3 in. down with soil not covered than in the surface application with soil covered, and this appears to be true to some extent regardless of the texture of the soil.

In order to obtain more reliable information as to the ultimate killing zone, experiments were carried out with wooden boxes 30 in. square, 15 in. deep, and open on the top, the boxes being filled with dry sandy soil to a depth of 12 in.

The results of the experiments, in which the yellow meal-worm was used, are reported in tabular form. It appears that the most effective killing zone within the depth of 6 to 8 in. is obtained if the dosage of carbon disulphid is applied at a depth of not less than 2 in. nor more than 4 in. At a depth of more than 4 in. there will be failure to kill all insects situated within 2 in. of the surface, and at a depth of less than 2 in. there will not be sufficient diffusion diagonally downward.

A comparison is made of field data obtained where applications of carbon disulphid were made at intervals along rows of early radishes infested with radish or cabbage maggots. The material was applied at a depth of about 3 in. with a space of from 2 to 3 ft. between the applications, in one series of applications 2 dr. being used at each point and in a second series 4 dr. Radishes and adjacent soil were examined five days later to a distance of 10 in. from the point of application, and it was found that applications of 2 dr. failed to kill all maggots at a distance of 1 in. and killed only a minor number at distances of 2 and 3 in. and beyond. Applications of 4 dr. killed all insects to a distance of 2 and 3 in., the percentage killed diminishing materially at a distance of 4 in. and becoming negligible at 6 in.

Origin of fumigation with hydrocyanic acid gas in California, G. COMFRE (Calif. Dept. Agr. Mo. Bul., 11 (1922), No. 5-6, pp. 438-442, figs. 2).—This is a historical account.

[Economic insects and their control in California] (Calif. Dept. Agr. Mo. Bul., 11 (1922), No. 7, pp. 7-11, 20-50).—Papers dealing with insects of importance in California and control measures, presented at the Convention of California County Horticultural Commissioners on October 27 and 28, 1921, at Los Angeles, include the following: The Grape Mealybug, by A. J. Flebut (pp. 7-11); Résumé of the Insecticide and Fungicide Law, by G. P. Gray (pp. 20-24); Spraying Deciduous Fruit Trees, by G. P. Weldon (pp. 24-30); Summary of Measures for Control of Red Spiders on Deciduous Trees, by E. R. de Ong (pp. 30-36); Control of the Citrus Red Spider, by A. D. Borden (pp. 36-39); Control of the Codling Moth in Walnuts, by H. J. Quayle (pp. 40-43); Control of Citricola Scale, by C. F. Collins (pp. 43-45); and Biological Control with Particular Reference to the Mealybug and Black-scale Work in Southern California, by H. M. Armitage (pp. 45-50).

Insects injurious to the principal crops of the South, W. NEWELL and E. W. BERGER (Fla. Plant Bd. Quart. Bul., 6 (1922), No. 4, pp. 97-116).—This article deals in general with the more important insect pests of southern crops, the arrangement being by crop attacked. The account concludes with a discussion of the major problems and insect enemies threatening the South.

Report of the imperial entomologist, T. B. FLETCHER (Agr. Research Inst., Pusa, Sci. Rpts., 1920-21, pp. 41-59, pls. 6).—This report includes a discussion of the occurrence of and work of the year with insect pests.

Insect pests and fungus diseases of fruit and hops, P. J. FRYER (Cambridge: Univ. Press, 1920, pp. XVI+728, pls. 24, figs. 383).—The several parts of this work deal with (1) insect pests of fruit and hops and means for their control (pp. 25-476), (2) fungus diseases of fruit and their control (pp. 477-628), and (3) spraying in theory and practice, with a spraying calendar (pp. 629-684). Tables and a calendar of insect pests, etc., are appended.

[Insects attacking flax in Ireland], H. A. LAFFERTY, J. G. RHYNEHART, and G. H. PETHYBRIDGE (Ireland Dept. Agr. and Tech. Instr. Jour., 22 (1922), No. 2, pp. 116-120, pls. 2).—Insects mentioned as enemies of flax in Ireland include the flax flea-beetle (*Longitarsus parvulus* Payk.), the large green capsid bug (*Calocoris bipunctatus* F.), the tarnished plant-bug, and the silver "Y" moth (*Plusia gamma*).

Insect enemies of the sweet potato, L. A. CATONI (*Rev. Agr. Puerto Rico*, 9 (1922), No. 111, pp. 25-28).—A brief account is given of *Euascepes batatae*, *Protoparce cingulata*, the sweet-potato weevil, *Chaetocnema amazona*, *Euthrips insularis*, and *Tetranychus* sp.

Insects affecting greenhouse plants, A. GIBSON and W. A. ROSS (*Canada Dept. Agr. Bul.* 7, n. ser. (1922), pp. 63, figs. 52).—This summary of information deals with the subject under the headings of recommendations for controlling greenhouse insects, leaf-eating insects, sucking insects, boring or root-destroying insects, animal pests other than insects, and natural control.

The insect fauna of the genus *Crataegus*, W. H. WELLHOUSE (*New York Cornell Sta. Mem.* 56 (1922), pp. 1045-1136, figs. 45).—This is a report of studies of insects that feed on species of hawthorn, extending over a period of three years. Following an introductory account, biological notes on insects feeding on *Crataegus* as observed by the author from 1917 to 1920 are presented, with a bibliography of 16 titles (pp. 1051-1089). This is followed by a catalogue of the insects injurious to *Crataegus* arranged by orders, the host, injury, distribution, and references being given for each pest listed. An index to the genera and species, of which 382 species representing 9 orders and 55 families are catalogued, is included.

The fungus insect fauna of a mesophytic woods in New Jersey, H. B. WEISS (*Biol. Soc. Wash. Proc.*, 35 (1922), pp. 125-128, pls. 2).—This is a report of results of a survey of an area of 15 acres of moist woods at Monmouth Junction, N. J.

The food plants of Indian forest insects, V-VII, C. F. C. BEESON (*Indian Forester*, 47 (1921), Nos. 1, pp. 21-25, 6, pp. 247-252; 48 (1922), No. 9, pp. 494-500).—This continuation of the papers previously noted (*E. S. R.*, 45, p. 568) lists species of the families Platypodidae, Scarabaeidae, and Scolytidae.

Improvements in the methods of preparing and using grasshopper baits, J. R. PARKER (*Montana Sta. Bul.* 148 (1922), pp. 19, fig. 1).—The first part of this bulletin (pp. 3-9), dealing with the use of amyl acetate as a substitute for citrus fruits in grasshopper baits, reports work conducted during 1920 and 1921, in continuation of that previously noted (*E. S. R.*, 45, p. 151). In the experiments conducted, the ordinary formula of 25 lbs. of bran, 1 lb. of salt, 1 lb. of arsenic, 2 qt. of molasses, 6 lemons, and 10 qt. of water was used as the standard, and tests were made of the effect of substituting amyl acetate in different strengths for the lemons and also of the effect of leaving out either the molasses or the salt.

The results obtained in 1920 during a heavy infestation of *Camnula pellucida* Scud., reported in tabular form, emphasize the superiority of amyl acetate to lemons. They indicate that 0.5 oz. of amyl acetate to 25 lbs. of bran is hardly enough, and also that salt is one of the most important ingredients, the two formulas in which it was left out having given poorer results than any of the others.

In 1921 tests were conducted on 13 different days where *C. pellucida*, *Melanoplus bivittatus* Say, and *M. atlantis* Rhl. were present, *C. pellucida* predominating. Amyl acetate was again shown to be superior to lemons as an attractant, and molasses seemed to add materially to the attractiveness of the bait, while salt alone gave almost as good results as the standard formula of lemons, molasses, and salt. In experiments with amyl acetate, salt, molasses, and lemons conducted with a view to determining which was the most attractive when used alone, the following formulas were tested: 25 lbs. of bran and 10 qt. of water with each of (1) 0.75 oz. of amyl acetate, (2) 1 lb. of salt, (3) 2 qt. of

molasses, and (4) 6 lemons. The results were somewhat variable. On three of the six days in which the tests were conducted amyl acetate attracted the greatest number of grasshoppers; salt, molasses, and lemons each headed the list on one day; and in the total results for six days amyl acetate was considerably in the lead, with but little difference between salt, molasses, and lemons. In practical control work in Montana during the years 1920 and 1921 a large quantity of amyl acetate was used, 2,300 oz. in 11 counties in 1920 and 120,000 oz. in 26 counties in 1921, uniformly good results being obtained. The advantages of amyl acetate over lemons and its physical properties are briefly considered.

In part 2 (pp. 10-19), the time of day to put out grasshopper baits is considered at some length. The great variation in the recommendations of entomologists in regard to the best time is pointed out in a review of the literature on the subject. Experimental work conducted during 1919, 1920, and 1921 is reported upon, as well as the results of general field observations and practical experience. The quickest and largest kills with the poisoned bran mash were obtained when it was applied in the late morning on warm, bright days when the grasshoppers were actively moving about. It appears that where large acreages are to be covered good results may be obtained by scattering from 9 a. m. until 3 p. m. "If the weather is extremely warm poisoned bran mash may be scattered as early as 7 a. m. and as late as 4 p. m. but in such cases should not be put out between 12 m. and 2 p. m. It should not be scattered during cool, cloudy weather at any hour of the day. A general rule to follow is to put out grasshopper poison only when the grasshoppers are actively moving about in search of food."

A list is given of 12 references to the literature.

A contribution to the anatomy and physiology of reproduction of Orthoptera, I, II, P. CAPPE DE BAILLON (*Cellule*, 31 (1920), No. 1, pp. 245, pls. 8, figs. 15; 32 (1922), No. 1, pp. 5-193, pls. 5, figs. 23).—This work deals with oviposition and emergence, the first part (pp. 1-245) of locusts and the second part (pp. 5-193) of crickets. The two parts include bibliographies of five and four pages, respectively.

A microbe pathogenic for locusts and other insects, *Micrococcus* (*Staphylococcus*) *acridicida* n. sp., H. KUFFERATH (*Ann. Gembloux*, 27 (1921), No. 8, pp. 253-257).—A bacterium which is the source of disease among locusts in Greece is described as new.

The rhododendron bug (*Leptobyrsa* (*Stephanitis*) *rhododendri* Horv.) (*Jour. Min. Agr.* [London], 29 (1922), No. 6, pp. 555-558, pl. 1).—This is an account of an introduced insect first observed in Great Britain in 1910. It has since become distributed throughout the rhododendron-growing districts of the southern and southwestern countries and occurs in East Anglia. It is found upon rhododendrons and in the United States on species of *Kalmia*, the newer rhododendron hybrids being far more susceptible to damage than the long-established *Rhododendron ponticum*. The obvious signs of injury are the presence of chocolate-brown spots on the underside of the leaf and a pale "freckling" on the upper surface. In more severe cases the whole plant appears to wilt, and where the attack is combined with unfavorable weather conditions, such as a prolonged drought, death may occur. A brief description and account of its life history and methods of control are given.

The Coccidae of Ceylon, E. E. GREEN (*London: Dulau & Co., Ltd.*, 1922, pt. 5, pp. 345-472, pls. 74, figs. 3; rev. in *Science*, 56 (1922), No. 1446, pp. 312, 313).—The fifth part of this work (*E. S. R.*, 24, p. 259) includes descriptions of new species representing 1 genus each of the subfamilies Eriococcinae,

Tachardiinae, Ortheziinae, and Margarodinae, 11 genera of the subfamily Dactylopiinae, and 6 genera of the subfamily Monophlebinae.

Studies on lime-sulphur mixture, C. HARUKAWA (*Ber. Ōhara Inst. Landw. Forsch.*, 2 (1921), No. 1, pp. 1-20).—A comparison was made of the effectiveness of two kinds of lime sulphur, the first being made by the use of equal quantities of lime and sulphur, while in the second the amount of lime was reduced to one-half the amount used in the first. There appears to be practically no difference in the effectiveness of the two kinds, and the power of reducing potassium permanganate is the same.

"Lime sulphur mixture seems to have no dissolving power toward the scales of *Aspidiotus duplex*. When scale insects had been sprayed with lime sulphur, attachments of the scales were loosened a certain time after the spraying, and some of the scales dropped from the tree. Not only the scales of the dead insects, but also those of the apparently alive insects dropped. After the scale insect was dead, the activities of oxidase and of catalase in the tissue of the insect decreased gradually. The results of study made using this phenomenon seem to show that the insects which did not change in color a certain time after the spraying were not dead at that time."

Contributions to a knowledge of the Crambinae.—II, Crambus laqueatellus Clem., G. A. AINSLIE (*Ann. Ent. Soc. Amer.*, 15 (1922), No. 2, pp. 125-136, figs. 2).—This second paper (*E. S. R.*, 40, p. 168) is a report of investigations of *C. laqueatellus*, including its systematic history, distribution, seasonal history, economic history, habits of the moths, descriptions of the several stages, and a list of 15 references to the literature cited. The economic status of this species remains to be determined.

The European corn borer at work, H. A. WALLACE (*Wallace's Farmer*, 47 (1922), No. 38, pp. 3, 23, figs. 3).—An account of the European corn borer situation in southern Ontario.

[**Studies of *Galleria mellonella* L.**] (*Wis. Acad. Sci., Arts, and Letters, Trans.*, 20 (1921), pp. 255-267, fig. 1).—Two papers reporting studies conducted at the zoological laboratory of the University of Wisconsin are presented, the first on Some Experiments with the Larva of the Bee Moth, *G. mellonella*, by J. E. Andrews (pp. 255-261), and The Length of Life of the Larva of the Wax Moth, *G. mellonella*, in Its Different Stadia, by R. W. Chase (pp. 263-267). The studies of Paddock are referred to (*E. S. R.*, 29, p. 859).

Impounding water in a bayou to control breeding of malaria mosquitoes, D. L. VAN DINE (*U. S. Dept. Agr. Bul. 1098* (1922), pp. 22, pls. 9, figs. 2).—This is a detailed account of work conducted on the Hecla plantation at Mound, Madison Parish, in northeastern Louisiana, including a map showing the impounded area and surroundings, a plan of the Hecla Dam, etc. There being no drainage outlet, the idea of clearing a section of one of the bayous and impounding the water to determine the effect of a change from the swamplike conditions of the natural bayou to the lakelike conditions of the impounded area on the capacity of the bayou for Anopheles production was carried out. By clearing of all vegetation and impounding the water by means of a cross levee, or fill, and spillway, the water over the bed of the stream above the dam was kept at a sufficient height to suppress the further growth of vegetation, and this clearing and impounding was found effective in preventing the breeding of Anopheles in the bayou, where formerly such breeding was common.

In cooperative work with the U. S. Bureau of Fisheries, the mosquito-eating top minnow (*Gambusia affinis*) was shown to be generally distributed in the region but to be ineffective in control under natural conditions by reason of

the protection afforded the mosquito larvae by aquatic and marginal vegetation and the vegetable debris upon the surface of the water.

A mosquito attractant, S. E. CRUMB (*Science*, 55 (1922), No. 1426, pp. 446, 447).—During the course of investigations, the author found that a degree of warmth somewhat above that of the surrounding air was highly and consistently attractive to a certain percentage of mosquitoes (*Culex pipiens*). In experiments conducted "there seemed to be no specific optimum temperature, but the maximum response occurred between 90 and 110° F., which represented temperatures from 15 to 30° higher than that of the surrounding air. When the temperature reached 120° less interest was displayed, and at 140° the mosquitoes were entirely dispersed. At temperatures below 85° there was very little response if any. . . . It was also found that mosquitoes in cages fed readily upon a solution of potassium arsenite in sweetened water, and that this material was highly toxic to them."

Mosquito eradication, W. E. HARDENBURG (*New York and London: McGraw-Hill Book Co., Inc.*, 1922, pp. IX+248, figs. 146).—This is an account of mosquito eradication by a sanitary engineer. The several chapters of the work relate, respectively, to the toll of the mosquito (pp. 1-16), some disease-bearing American mosquitoes (pp. 17-49), development of control measures (pp. 50-65), initiating the campaign (pp. 66-82), administrative aspects of the campaign (pp. 83-98), inland drainage (pp. 99-138), salt marsh drainage (pp. 139-157), oiling (pp. 158-171), fish control (pp. 172-194), screening (pp. 195-208), other measures and expedients and points requiring investigation (pp. 209-218), and rural mosquito and malaria control (pp. 219-227).

The several appendixes consist, respectively, of (1) a table to determine species of certain common American mosquitoes (pp. 228-232), (2) an approved antimosquito ordinance (pp. 233-234), (3) a suggested antimosquito leaflet for campaign educational work (pp. 235-237), and (4) a bibliography (pp. 238-240).

Studies on Microsporidia parasitic in mosquitoes, II, R. KUDO (*Jour. Parasitol.*, 8 (1921), No. 2, pp. 70-77, fig. 1).—The second paper on the subject (E. S. R., 47, p. 256) deals with the effect of the parasites upon the host body.

The author finds that microsporidian infection is often lethal in its effect upon the mosquito larvae. In captivity such larvae die in much shorter time than uninfected ones. Pupae and adults thus far examined have been found to be free from the infection. A new microsporidian, *Theclohania opacita*, parasitic in *Culex apicalis* collected at Spring Valley, N. Y., is described. The geographical distribution of Microsporidia parasitic in mosquitoes is shown, and a list of seven papers relating to the subject is included.

An extreme case of delayed fall emergence of Hessian fly, W. H. LARRIMER (*Ann. Ent. Soc. Amer.*, 15 (1922), No. 2, pp. 177-180, figs. 3).—A delay in fall emergence of the Hessian fly brought about by a subnormal mean temperature of from 3 to 6° during the summer over the northern portion of the east Central States, with the exception of a small isolated area in north-central Illinois, is reported upon.

Hessian fly control in 1921 and 1922, H. A. GOSSARD and T. H. PARKS (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 9-10, pp. 160-167, fig. 1).—This is a review of work carried on in Ohio during the last two years.

The morphology and biology of a Canadian cattle-infesting black fly, *Simulium simile* Mal. (Diptera, Simuliidae), A. E. CAMERON (*Canada Dept. Agr. Bul.* 5, n. ser. (1922), pp. 26, figs. 9).—This is an account of a species of black fly that, in Saskatchewan, passes its preadult stages in the stony rapids of the North and South Saskatchewan Rivers.

Overwintering of flies, H. KOBAYASHI (*Japan Med. World*, 1 (1921), No. 3, pp. 11-14).—This is a report of studies conducted at the Chosen Government General Hospital, Keijo (Seoul). The author finds that individual house flies, principally females, overwinter in the adult stage, and it is quite probable that there are certain places in Keijo where the continual breeding of flies occurs in the winter. There is no evidence that the larvae and pupae overwinter. Feeding experiments indicate that the longevity of the adults is more than 120 days in the winter.

"*Scatophaga stercoraria* and *Calliphora lata* may also overwinter in the adult stage. *Stomoxys calcitrans*, *Sarcophaga carnaria*, *Fannia canicularis*, *Sepeis* sp. and *Ophyra nigra* (?) seem to overwinter in the pupal or larval stages."

On the further notes of the overwintering of house flies, H. KOBAYASHI (*Japan Med. World*, 2 (1922), No. 7, pp. 193-196).—This is a report of observations and experiments conducted at Keijo (Seoul), in continuation of those above noted. It was found that both male and female adults overwinter, but there is no evidence that the pupal and larval stages do so, and it apparently rarely occurs.

"*Muscina stabulans*, as well as *Musca domestica*, overwinters in adult stage, especially its female sex. *Fannia canicularis* and *F. scalaris* seem to overwinter both in adult and pupal stage. *Lucilia* and *Sarcophaga* overwinter exclusively in the pupal stage. *Calliphora lata* overwinters in adult stage, and there may be a continual breeding in winter. *Ophyra nigra* overwinters in pupal and larval stage. *Stomoxys calcitrans* overwinters in pupal stage. *Mesembrina* sp. overwinters in adult stage, especially its female sex. *Scatophaga stercoraria* and several species of *Anthomyia* overwinter in adult stage."

Wohlfahrtia vigil (Wlk.) as a human parasite (Diptera: Sarcophagidae), E. M. WALKER (*Jour. Parasitol.*, 7 (1920), No. 1, pp. 1-7, pls. 2).—Instances of subcutaneous parasitism of children by this sarcophagid are recorded.

Some cases of cutaneous myiasis, with notes on the larvae of Wohlfahrtia vigil (Wlk.), E. M. WALKER (*Jour. Parasitol.*, 9 (1922), No. 1, pp. 1-5, pls. 3).—This account supplements the paper by the author above noted.

Combating the olive fly (*Dacus oleae* Rossi) in various countries, F. BILBAO Y SEVILLA ET AL. (*Enquête sur la Lutte Contre la Mouche des Olives (*Dacus oleae*) dans les Divers Pays. Rome: Inst. Internatl. Agr., Bur. Renseig. Agr. et Maladies Plantes, 1922, pp. VII+89*).—This is a supplement to the report by F. Bilbao y Sevilla to the sixth general assembly of the International Institute of Agriculture, in May, 1922. It consists of reports received from Spain, France, Algeria, Morocco, Tunis, British India, South Africa, and Italy. Abstracts of contributions on the subject are appended (pp. 75-89).

Twenty years of control work with the olive fly [*Dacus oleae*] in Italy, E. MALENOTTI (*Nuovi Ann. [Italy] Min. Agr.*, 1 (1921), No. 2, pp. 348-390).—This account includes a bibliography of eight pages arranged by years.

Insect pests of the horticulturalist: Their nature and control.—I, Onion, carrot, and celery flies, K. M. SMITH and J. C. M. GARDNER (*London: Benn Bros., Ltd., 1922, vol. 1, pp. VI+76, pls. 11, figs. 27*).—This volume contains chapters on the life history, damage to plants, and control of the celery fly, *Acidia heraclei* L. (pp. 5-31); the carrot fly (*Psila rosae*) and onion maggot, with some preliminary attempts at their control (pp. 32-48); control of the onion maggot, being a short account of some further control work (pp. 49-53); and the bionomics of the carrot fly, with some further methods of control (pp. 54-74).

Protecting cabbage from the root maggot, H. E. HODGKISS and J. L. HORSFALL (*Penn. State Col. Ext. Circ. 93* (1922), pp. 15, figs. 7).—In control work

with the cabbage maggot in Pennsylvania, experiments during two years have demonstrated that the use of tar felt disks will prevent practically all loss of plants. The use of corrosive sublimate solution has also given most promising results, in many instances only one application being necessary. Another advantage was found in its fungicidal action, its use having practically eliminated blackleg (*Phoma* sp.) from experimental plats during the season of 1921, whereas on check plats serious loss resulted from the disease. In experiments in which about 4,000 plants were treated with carbolic acid emulsion, the loss due to maggot injury was less than 3 per cent on plants treated twice and 10 per cent on those treated once, whereas a loss of 77 per cent resulted on a row of untreated plants. The use of cheesecloth screens for the protection of late cabbage plants in the seed bed has been found to be of value both for its protection against maggot injury and in keeping young plants free from other insects, and in conserving moisture in the soil.

"Tar felt disks are a protection only when applied immediately after setting out the plants. The corrosive sublimate and carbolic acid emulsion treatments should be applied as soon as plants are set, but, if this is not possible, then it should be done within the next five days and before any eggs which may have been deposited have had time to hatch. For a delayed treatment either of the liquids may be employed, but the corrosive sublimate gives the best results with the minimum number of treatments."

Diptera and fungi, H. B. WEISS (*Biol. Soc. Wash. Proc.*, 34 (1921), pp. 85-88).—This paper, supplementing those previously noted (*Id. S. R.*, 45, p. 253), calls attention to certain dipterous families which are more or less closely associated with fungi, particularly the fleshy fungi belonging to the families Agaricaceae and Polyporaceae. The fungus habit appears to be most pronounced in the Mycetophallidae and Platypetidae.

Additional notes on fungus insects, H. B. WEISS and E. WEST (*Biol. Soc. Wash. Proc.*, 34 (1921), pp. 167-171, pl. 1).—These notes deal mainly with fungus insect records which have accumulated since the publication of the paper noted above.

Museum pests feeding on glycerin jelly slides, W. C. KRAATZ (*Science*, 55 (1922), No. 1433, p. 644).—The author records the feeding of dermestid beetle larvae upon microscopic slides mounted in glycerin jelly.

A contribution to the study of the parasites of *Pieris brassicae* L., F. PICARD (*Bul. Biol. France et Belg.*, 56 (1922), No. 1, pp. 54-130).—An extended account, in which, under the heading of parasites of the larva, the author deals with (1) *Apanteles glomeratus* L. and its hyperparasites *Tetrastichus rapo* Wlk., *Dibrachys boucheanus* Ratzb., *Eutelus mediterraneus* Mayr., *Habrocytus* sp. (?), *Hemiteles fulvipes* Grav., and *H. longicauda* Thoms.; (2) *Anilastus ebeninus* Grav. and its parasites, among which is *Angitia* sp. (?); and (3) *Compsilura concinnata* Melg. Parasites of the pupa considered are *Pteromalus puparum* L., *Dibrachys* sp., and *Pimpla instigator* F. A bibliography of 39 titles is included.

A new parasite of the spruce budworm, S. A. ROHWER (*Canad. Ent.*, 54 (1922), No. 7, pp. 155, 156).—A parasite reared from the spruce budworm (*Tortrix fumiferana* Clem.), from Lillooet, B. C., by A. B. Baird, is described as new under the name *Phytodictus fumiferanae*.

Fern weevil parasite, C. E. PEMBERTON (*Hawaii. Forester and Agr.*, 19 (1922), No. 9, pp. 199, 200).—The fern weevil (*Syagrus fulvitaris*) parasite, *Ischiogonus syagrii*, introduced by the author from Australia in 1921, is said to have become well established and to be holding the pest in check on the island of Maui.

Biology of the goldenrod gall-maker *Gnorimoschema gallaesolidaginis* RIL., R. W. LEIDY (*Jour. N. Y. Ent. Soc.*, 30 (1922), No. 2, pp. 81-94, pl. 1, figs. 2).—This paper includes an account of the history and distribution of *G. gallaesolidaginis*, its life history and habits, technical descriptions of its several stages, and brief notes on the several parasites that attack it.

Studies on the peach sawfly (*Eriocampoides matsumotonis* Mats.), C. HARUKAWA (*Ber. Ōhara Inst. Landw. Forsch.*, 2 (1921), No. 1, pp. 21-46, pls. 2).—This is an account of the peach sawfly of Japan, which has been under the author's observation in Okayama Prefecture since the year 1916, and is known to occur in a few other prefectures.

There are three broods each year, the larvae of the third generation overwintering in the cocoon. The adult begins oviposition on the day of emergence without mating, and the unfertilized eggs produce only male sawflies. The average number of eggs laid by an individual is about 20. The longevity of the adult averages from 2 to 5 days, the egg period lasts from 7 to 11 days according to the season, and the larval period from 14 to 23 days, the longest larval period being found in the third generation. The larva molts five or six times, and when full grown goes into the soil to make its cocoon. The true pupal period is about 4 or 5 days, and the duration from its entering into the soil to the emergence of the adult about two weeks. It attacks the peach and pear and, less frequently, the Japanese sand pear, plum, cherry, and the Japanese flowering cherry, the preference being probably in the order given.

FOODS—HUMAN NUTRITION.

Nutrition studies of some new varieties of citrus fruits and avocados, M. E. JAFFA ET AL. (*Calif. Avocado Assoc. Ann. Rpt.*, 1921-1922, pp. 58-64).—Proximate analyses are reported of the tangelo, a hybrid produced between the pomelo and the tangerine, the orange-lemon hybrid; and the citrange, a hybrid between a common sweet orange and the trifoliate orange. These analyses show that the acid content of the tangelo approaches that of the grapefruit, and that the percentage of sugar is only slightly higher than that of the grapefruit. In the orange-lemon hybrid the acidity and sugar content correspond to that found in the lemon, while the physical characteristics resemble those of the orange. The citrange in its content of sugar and acid is halfway between a lemon and an orange.

Iron analysis of kale and turnip greens, M. EICHELEBERGER and M. ASBURY (*Jour. Home Econ.*, 14 (1922), No. 3, pp. 131, 132).—The average iron content found was for kale 0.00312, turnip greens 0.00269, and spinach 0.002716 per cent, respectively.

Suggestions for a home economics research problem in household physics (*Jour. Home Econ.*, 14 (1922), No. 6, pp. 273, 274).—The research committee of the American Home Economics Association suggests the effect of the different utensils on the rate of cooking as a problem that might be profitably studied and makes some suggestions for such work.

Valuable table for the mother who wishes to feed her family intelligently (*Child Welfare Jour.*, 1 (1922), No. 1, pp. 23, 24).—A statement based on data prepared for publication in the Office of Home Economics, States Relations Service, U. S. D. A.

Weights of one cupful of food materials, S. WOODRUFF (*Jour. Home Econ.*, 14 (1922), No. 6, pp. 270-274).—Data are reported regarding the weight of one cupful of a considerable number of food materials, and also regarding the weight of a teaspoonful of baking powder of different sorts, cream of tartar, and medium fine table salt.

Industrial plant cafeteria, S. HADWEN (*Hotel Mo.*, 30 (1922), No. 350, pp. 68, 69, figs. 2).—An account is given of the equipment and operation of a cafeteria in an industrial plant in Columbus, Ohio.

Factors to be considered in planning the establishment of a cafeteria, M. A. PROCTOR (*Jour. Home Econ.*, 14 (1922), No. 7, pp. 314-319).—A discussion which summarizes a considerable amount of data.

The value of the examination of food handlers (*N. Y. City Dept. Health, Food and Drug Bul.*, 4 (1922), No. 8, pp. 69, 70).—The need for physical examination of those who handle food is discussed as a matter of protection to the health of the community, and some results obtained in such work in New York City are given. "Undoubtedly scores of individuals working as waitresses, cooks, milk handlers, confectioners, and in other capacities, who come in contact with the food consumed by this community, are suffering from communicable disease which remains unrevealed, either because the individuals are poorly examined, or because they do not submit to any examination whatever."

Factors influencing nutrition work among Italians, L. H. GILLET (*Jour. Home Econ.*, 14 (1922), No. 1, pp. 14-19).—The information summarized here is of special use in work among the foreign born.

Mass child feeding in Germany, F. M. BURKLE (*Jour. Home Econ.*, 14 (1922), No. 5, pp. 207-212).—A considerable amount of information is summarized in this descriptive article.

The basal metabolism and food consumption of underweight college women, K. BLUNT and V. BAUER (*Jour. Home Econ.*, 14 (1922), Nos. 4, pp. 171-180; 5, pp. 226-232).—This report of extended investigations of underweight college women had to do with standards of weight for young women and the extent and harm of underweight; the effect of underweight on basal metabolism as shown by investigations already published and by the observations here reported on a group of underweight college women; and observations on the food consumption of this underweight group. Results of the laboratory studies are reported at length and discussed in detail. The authors' summary of the results obtained follows:

"A group of 10 college women who were underweight by comparison with life insurance standards and who were of a nervous type were studied to determine their basal metabolism and their food consumption. Their basal metabolism, like that of some underweight women observed in the [Carnegie Nutrition Research] Laboratory, averaged almost normal. Their food consumption, however, was low, averaging only 1,830 calories, or 37.3 calories per kilo. Eleven of them ate less than 500 calories above their basal metabolism, one, on the two days observed, even less than her basal, and two whose current loss in weight was especially marked, only 137 and 210 calories above. From these facts and a discussion of their probable requirement, it is concluded that many of the group were hardly eating enough for their daily needs and certainly not enough for any marked gain in weight."

Growth and reproduction upon simplified food supply (*Jour. Biol. Chem.*, 53 (1922), No. 1, pp. 41-52).—Continuing the investigation previously noted (*E. S. R.*, 45, p. 864), two papers are presented.

II. *Influence of food upon mother and young during the lactation period*, H. C. Sherman and M. Muhlfeld (pp. 41-47).—This has been essentially noted from a preliminary report (*E. S. R.*, 46, p. 862).

III. *The efficiency of growth as influenced by the proportion of milk in the diet*, H. C. Sherman and J. Crocker (pp. 49-52).—The above investigation has been extended to a study of the effect of different proportions of milk in the diet on the rate and efficiency of growth of the young after weaning. Four

diets were used consisting, respectively, of $\frac{1}{4}$, $\frac{1}{3}$, $\frac{1}{2}$, and $\frac{3}{4}$ whole milk powder, with $\frac{3}{4}$, $\frac{2}{3}$, $\frac{1}{2}$, and $\frac{1}{4}$ ground whole wheat. Each diet also contained sodium chlorid to the extent of 2 per cent of the weight of the wheat. The efficiency of growth of these diets was determined by comparing the gains in weight per 1,000 calories of food consumed during a period of four weeks, the fifth to eighth weeks inclusive of the life of the rat. Each diet was tested from 30 to 39 times and upon from 129 to 164 rats.

The diet in which milk furnished $\frac{1}{4}$ of the solids or $\frac{1}{4}$ of the calories of the food was adequate, but much less efficient than those in which the proportion of milk was higher. This is shown by the average gain in grams per 1,000 calories of food eaten for the four diets used, in the order of increasing proportion of milk, the results being 54 ± 0.6 , 73 ± 0.8 , 74 ± 1.1 , and 76 ± 1.1 gm.

The effect of a high protein diet on the blood catalase, W. E. BURGE and J. M. LEICHSENKING (*Amer. Jour. Physiol.*, 61 (1922), No. 3, pp. 574-576, fig. 1).—Detailed results are presented of determinations of the catalase content of the blood of a dog when fasting and after the ingestion of large amounts of meat. An increase in the blood catalase after each meal of meat is shown, as well as a general increase of catalase following the ingestion of large quantities of meat for several successive days.

Animal calorimetry.—XXII, The production of fat from protein, H. V. ATKINSON, D. RAPPORT, and G. LUSK (*Jour. Biol. Chem.*, 53 (1922), No. 1, pp. 155-166).—In this contribution to the series of studies on animal calorimetry which have been noted in part (*E. S. R.*, 47, p. 63), data previously reported by Atkinson and Lusk on the effect of meat ingestion on hourly metabolism are quoted and discussed, and additional data along the same lines are presented. In the new series of experiments an additional procedure is included. A standard diet containing 70 gm. of starch was given every day at 5 p. m. to charge the glycogen reservoirs of the body, and the meat was given in the morning.

The respiratory quotients obtained in the earlier experiments showed that only after the ingestion of meat in large quantities, 1,100 and 1,300 gm., was there any evidence of the conversion of protein into fat as the dominant feature of the process. With smaller amounts of meat the excess was evidently retained in the proportion of 1 gm. of fat to every 2 gm. of glycogen. In this series of experiments it was also noted that following the prolonged ingestion of meat in large amounts the basal metabolism may rise from a former level of 16 calories per hour to one of 19.7, from which level it slowly falls with a gradual elimination of the so-called "deposit protein."

When the animal was given sufficient starch to fill the glycogen reservoirs as in the new series of experiments, the result of the ingestion of a large amount of meat was the formation of fat from the protein as determined by the respiratory quotient. It is concluded that the formation of fat from protein depends largely upon the amount of glycogen present in the body.

Fat excretion, E. HILL and W. R. BLOOR (*Jour. Biol. Chem.*, 53 (1922), No. 1, pp. 171-178).—To determine the source of the fat of the feces, cats were fed a basal fat-free diet supplemented in some cases by lean meat, coconut oil, and olive oil, respectively, in each case the amount of food being such as to supply 100 calories per kilogram of body weight. Determinations were made of the quantity of the fat in the feces and of its melting point and iodine number. Four animals were used in each set.

The total amount of fat in the feces was highest on the meat diet and lowest on the fat-free diet. The iodine number varied from 24.8 on the coconut oil to 44.6 on the olive oil diet, but in no case did it approach the value of the fat fed.

The melting point of the feces fat was relatively constant, but consistently lower on the fat diets than on either the fat-free or the meat diet. The authors conclude that "the comparative constancy of composition of the feces fat favors the idea of a fat excretion from the intestine, but while an excretion is probable it can not be regarded as proved in view of the undetermined influence of lipid from free cellular material."

Endocrinology and metabolism, edited by L. F. BARKER ET AL. (*New York and London: D. Appleton & Co., 1922, vols. 1, pp. XXII+982, pls. 3, figs. 190; 2, pp. XXIV+995, figs. 273; 3, pp. XI+956, pls. 2, figs. 76; 4, pp. XII+958, figs. 60; 5, pp. IV+879*).—This extensive treatise upon metabolism and the internal secretions in health and disease is the work of 98 contributors. The first two volumes deal with the various endocrine glands and their diseases, the third with normal metabolism, and the fourth with general and special pathological metabolism. The fifth volume contains a bibliography, arranged according to the sections of the previous volumes, and a general index.

Vitamins and the choice of food, V. G. and R. H. A. PLIMMER (*London and New York: Longmans, Green & Co., 1922, pp. XII+164, pls. 8, figs. 10*).—This volume presents in a nontechnical manner the history of the deficiency diseases, beriberi and scurvy, and of the discovery of the vitamins; a summary of the distribution and properties of the vitamins; a discussion of rickets, keratomalacia, and pellagra as deficiency diseases; and a final discussion of the effect of partial deficiencies in the food and common errors in the choice of foods. A list of the relative distribution of the vitamins in foods and notes on the particular value of the various foodstuffs are given in an appendix.

Vitamins essential food factors, B. HARROW (*New York: E. P. Dutton & Co., 1922, [2.] ed., enl., pp. XIII+261, figs. 8*).—In this revision of the volume previously noted (*E. S. R.*, 45, p. 562), the subject matter of the text has been unaltered, but two appendixes have been added. One of these describes laboratory work illustrating certain features of the book, and the other summarizes some of the literature on vitamins which has appeared since the first edition.

Observations on the presence of the antineuritic substance, water-soluble B, in chlorophyll-free plants, C. R. ORTON, E. V. MCCOLLUM, and N. SIMMONDS (*Jour. Biol. Chem.*, 53 (1922), No. 1, pp. 1-6, fig. 1).—Two rats, which had begun to decline on a diet deficient in vitamin B, responded with rapid growth to the introduction of 9 per cent of dried mushroom (*Agaricus campestris*), in place of an equivalent amount of dextrin. The results obtained with onion root were less conclusive, as one animal died soon after 4.4 per cent of onion was introduced into the ration and the other responded with slow growth for about three weeks, after which it again lost weight. Dried Indian pipe (*Monotropia uniflora*) gave inconclusive results, and dodder (*Cuscuta gronovii*) proved toxic and caused the death of the experimental animals.

Microbial physiology and the accessory factor of growth, P. GOY (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 24, pp. 1579, 1580).—In continuation of the study previously noted (*E. S. R.*, 45, p. 465), further properties of the growth-promoting substance isolated from cultures of *Mucor mucedo* and other unicellular organisms are reported briefly. The active substance is said to be dialyzable through collodion and parchment paper; soluble in water, alcohol, and ether; and indifferent to the reaction of the medium in which it is heated. This growth factor is considered not to be identical with vitamin B.

The influence of avitaminosis on lactation, E. WOLLMAN and M. VAGLIANO (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 25, pp. 1637-1639, fig. 1).—The failure of suckling animals to grow when the diet of the mother is deficient in vitamins is shown by data obtained from feeding experiments with

rats to be due not only to the lack of vitamins in the milk but also to an insufficiency in the milk supply. When placed on a diet deficient in vitamins A and B, rats continued for about eight days to furnish milk of sufficient quality and quantity for the development of the young. If when growth had ceased the young were given either supplementary vitamins or milk in which the vitamins had been destroyed by heat and oxidation no improvement was noted, but if both vitamins and vitamin-free milk were supplied, growth was promptly resumed.

The pathological physiology of deficiency disease, A. BICKEL (*Deut. Med. Wchnschr.*, 48 (1922), No. 29, pp. 965, 966).—This is a further discussion of the author's theory that the essential function of vitamins is to enable the body cells to assimilate and utilize digested food materials (E. S. R., 47, p. 265). Experiments are noted briefly showing that wounds in dogs on a vitamin-free ration heal more slowly and become more easily infected than in dogs on a complete diet, and that animals forced to exercise when on a vitamin-free ration die sooner than animals at rest. The predominance of the nerve symptoms in pigeons and in man, as compared with quadrupeds, on diets lacking vitamin [B] is attributed to the greater muscular strain of balancing on two legs.

Yeast therapy and uric acid excretion, A. H. SMITH, H. J. DEVEL, JR., L. ASCHAM, and F. B. SEIBERT (*Jour. Lab. and Clin. Med.*, 7 (1922), No. 8, pp. 473-476, figs. 4).—The ingestion of from three to six or more cakes of bakers' yeast daily was found to result in no increase in uric-acid excretion over the level obtained on a purin-low diet in four subjects who continued the experiment for from 6 to 10 days. There was no significant change in the H-ion concentration of the urine in any case. Viable yeast cells were found in the feces in large numbers during the yeast period, but disappeared promptly after the ingestion of yeast was stopped. It is concluded that the ingestion of live yeast is not followed by a marked increase in metabolism, and that the yeast does not continue to grow in the human intestine even after repeated seeding.

Studies of urinary acidity.—I, **Some effects of drinking large amounts of orange juice and sour milk**, N. R. BLATHERWICK and M. L. LONG (*Jour. Biol. Chem.*, 53 (1922), No. 1, pp. 103-109).—To determine whether the tolerance of man for naturally occurring fruit juices can be exceeded, a study was made of the effect on the composition of the urine and the carbon dioxide capacity of the plasma of the ingestion of increasing amounts of strained orange juice. The two subjects were given a daily diet consisting of baked potatoes 260, whole milk 440, graham crackers 300, raw apple 150, cheese 25, and butter 45 gm., and in the case of one subject egg 65 gm. After 4 days on this diet orange juice was added, beginning with 600 cc. and increasing by 600 cc. daily to 2,400 cc. The urine was analyzed daily for H-ion concentration, organic acids, ammonia, and nitrogen, and occasional determinations were made of the carbon dioxide capacity of the blood plasma.

The effect of consuming large amounts of lactic acid milk was also studied. The subjects in this case took a basal diet of 2 liters of whole milk and 340 gm. of soda crackers daily for 2 days, and for the 2 following days substituted for the whole milk an equal amount of lactic acid milk to which sufficient cream had been added to make up the fat content to that of the whole milk. The lactic acid milk was prepared by inoculating skim milk with a lactic acid-producing culture and allowing it to ferment for 12 hours at 37° C., the resulting acidity being about 2 per cent calculated as lactic acid.

The effect on the urine of drinking large amounts of orange juice consisted of a marked increase in the pH value, representing a lowered acidity, an in-

creased excretion of organic acids, and a marked decrease in the ammonia output. The ingestion of large amounts of lactic acid milk caused a marked decrease in pH, representing increased acidity, a marked increase in the titratable acidity, a significant increase in the ammonia output, and no change in the organic acidity.

In the orange juice experiments there were no significant changes in the plasma carbon dioxid capacity. In the lactic acid experiments the results obtained, while slightly different with the two subjects, showed that there was a slight reduction in the carbon dioxid capacity of the plasma.

Factors controlling the intestinal bacteria.—The effect of acute obstruction and stasis on bacterial types, L. R. and C. A. DRAGSTEDT and P. R. CANNON (*Jour. Infect. Diseases*, 31 (1922), No. 3, pp. 209-214).—Continuing the observations previously noted (E. S. R., 44, p. 66), further evidence is presented that intestinal obstruction leads to the development of a proteolytic intestinal flora irrespective of the character of the diet. Experiments with closed intestinal loops are also reported, the results of which demonstrate that the intestinal juice is not bactericidal, at least for the proteolytic group of organisms. The disappearance of Gram-positive aciduric organisms from closed intestinal loops is attributed to the absence of utilizable carbohydrate and to the alkaline reaction of the medium.

Studies on the thermal death time of spores of *Clostridium botulinum*.—Preliminary report, E. C. DICKSON, G. S. BURKE, D. BECK, J. JOHNSTON, and H. KING (*Jour. Amer. Med. Assoc.*, 79 (1922), No. 15, pp. 1239, 1240).—This is a preliminary report of studies of the thermal death time of spores of *C. botulinum* under conditions which may apply in the processing of preserved foods. A peptic digest glucose broth of pH 7 to 7.5 was used as the medium for spore development of most of the strains examined, but for some it was found necessary to use other media such as gelatin vegetable juice, pea gelatin, spinach gelatin, bean gelatin, and brain or meat media. Only the more resistant strains as tested by preliminary resistance tests were used. The method of heating the spores first used was the open method of Bigelow and Esty (E. S. R., 45, p. 10), but for this was later substituted the closed tube method of Dickson and Burke previously described (E. S. R., 46, p. 763).

There proved to be marked variations not only in the heat resistance of different strains of *C. botulinum*, but also in the resistance of spores of the same culture of the same strain. "From observations based on approximately 40,000 tubes, it appears that about 95 per cent of the spores are destroyed comparatively quickly, and that among the remaining 5 per cent there are a few spores which are much more resistant. If this is true, it explains why only a few tubes in a series show the maximum heat resistance time, or a few cans in a pack show botulinus contamination, and also suggests as a reason for the average lower resistance time when but few spores are present in the heating mixture, that among the few spores there is less probability of a highly resistant spore being present."

Other points noted are that there is occasionally a marked delay of germination of the spores after they have been heated, the longest delay thus far observed being 330 days; that the age of spores which have been kept at room temperature in the culture medium does not materially influence their resistance to heat after their equilibrium of resistance has been reached; and that the reaction of the material in which the spores are heated plays an important part in determining their resistance to heat. The maximum resistance occurs when the medium is approximately neutral, and the resistance rapidly decreases as the H-ion concentration approaches both the acid and alkaline ranges.

The maximum survival time reported was 315 minutes in oil-stratified broth at 100° C. and the minimum 4 minutes in broth heated at 121°.

Clostridium botulinum.—II, Presence in the human alimentary tract, F. W. TANNER and G. M. DACK (*Jour. Amer. Med. Assoc.*, 79 (1922), No. 2, pp. 132, 133).—Continuing the study previously noted (E. S. R., 47, p. 679), 10 samples of feces from healthy persons were examined for *Bacillus botulinus* (*C. botulinum*).

Two of the specimens were found to contain the organism and five other specimens gave strong evidence of its presence. The two strains absolutely identified produced in sheep brain medium powerful toxins of type B.

ANIMAL PRODUCTION.

Handbook of general genetics, M. J. SIRKS (*Handboek der Algemeene Erfelijkheidsteor.* The Hague: Martinus Nijhoff, 1922, pp. X+494, pls. 5, figs. 127).—This book deals with the fundamental principles of genetics as applied to plant and animal breeding and includes discussions of biometry; history of the theories of heredity; Mendelism; nature, location, relation, and splitting of factors; uniformity of F₁ individuals; influence of sex in reciprocal crosses; sex linkage; and pure lines. The book is concluded with a chapter on the limits of the laws of heredity and their application. An extensive bibliography of 23 pages is also included.

The variability of correlations with domestic animals, E. FEIGE (*Fühling's Landw. Ztg.*, 70 (1921), No. 3-4, pp. 61-69).—The author discusses the variability which occurs when animal characters are correlated, with special reference to dairy cattle. The improbability of absolute correlations existing between milk production and body characters is also brought out. A table is presented showing theoretical complete correlation between characters in which the coefficient of correlation would equal unity.

Inheritance of plumage color in crosses of buff and Columbian fowls, L. C. DUNN (*Amer. Nat.*, 56 (1922), No. 644, pp. 242-255).—From the results of experiments at the Connecticut Storrs Experiment Station in which Columbian roosters and hens were crossed with Light Brahmas and Buff Orpingtons, it was determined the Columbian plumage is differentiated from buff plumage by the factor S, which is sex-linked and dominant over s, which permits buff plumage. The amount of black pigment developed in the feathers seems to depend upon a number of factors which may be present in the buff birds, since more or less black is almost always found in them, indicating that the buff and Columbian colorations have developed from the same pattern by a single factor mutation.

Noncrisscross inheritance in *Drosophila melanogaster*, L. V. MORGAN (*Biol. Bul. Mar. Biol. Lab. Woods Hole*, 42 (1922), No. 5, pp. 267-274, figs. 3).—The author reports the occurrence in a culture of *D. melanogaster* of a female fly which transmitted a recessive sex-linked character to her daughters instead of her sons as would normally be expected. This fly, which was described as having a gray head and thorax, with eyes slightly bar, and abdomen yellow, was mated to a black male and produced 43 yellow daughters and 59 gray sons, all with wild type eyes except 2 sons, which probably resulted from previous mating. The F₁ males were all sterile, but the F₁ females were fertile, as well as their offspring of both sexes.

The conclusion drawn was that the original female had received from its father two yellow-bearing chromosomes which remained inseparable during future generations. This meant that she formed eggs with the double X-chromosome and others with no X-chromosome. Fertilizing the XX eggs by X and

Y sperms produced triploid-X females which would die and XXY females which were the yellow daughters (fertile). The no-chromosome eggs fertilized by X and Y sperms produced XO males like their father but sterile, and YO males which would die. The sons of the F₁ females differed from the F₁ males in that they received a Y-chromosome from their mothers, and thus the living ones were fertile.

No exceptions in this type of inheritance occurred until the F₂ generation when 1 yellow male appeared, presumably due to the chromosomes of the mother breaking apart. Triploid-X females have lived in a few cases, but they are always weak and sterile. Cytological investigations gave further proof of the attachment between the two X-chromosomes. A practical use of these double yellow females has been found in keeping a supply of certain types of males by breeding them to these females. Since the XX eggs from these females produce only female offspring, the males produced are from the Y egg of the female fertilized by the X sperm of the male.

Complete linkage in *Drosophila melanogaster*, M. S. and J. W. GOWEN (*Amer. Nat.*, 56 (1922), No. 644, pp. 286-288).—The authors report the occurrence at the Maine Experiment Station of a strain of *D. melanogaster* which showed complete linkage in the sex chromosome in the region from scute to forked, in the second chromosome between black and purple, and in the third chromosome from dichæte to hairless. The causal factor for this linkage appeared to be located in the region of dichæte and hairless in the third chromosome and acts as a recessive.

Other cases of complete linkage which have appeared in the literature are cited, and the possibilities of selecting a race of noncrossovers is suggested.

Experimental studies on the duration of life.—III, The effect of successive etherizations on the duration of life of *Drosophila*, R. PEARL and S. L. PARKER (*Amer. Nat.*, 56 (1922), No. 644, pp. 273-280, figs. 2).—In continuing the studies previously reported (*E. S. R.*, 47, p. 864), the length of life of different lots of 4,330 flies etherized once at 1 hour of age, once at 12 hours of age, once at 36 hours of age, once at 3½ days of age, twice at 7 and 14 days of age, 3 times at 7, 14, and 21 days of age, and 4 times at 7, 14, 21, and 28 days of age was found not to influence the length of life of the flies, at least up to 4 times of etherizing during the life of the fly.

The sex-linked group of mutant characters in *Drosophila willistoni*, R. C. LANCEFIELD and C. W. MERZ (*Amer. Nat.*, 56 (1922), No. 644, pp. 211-241, figs. 20).—In supplementing the paper on the sex chromosome relationships of *D. willistoni* and *D. melanogaster*¹ in which it was shown that unlike *melanogaster* one of the large V-shaped pairs of chromosomes formed the sex chromosomes in *willistoni*, the authors report a comparative study of the genetic behavior of the 28 sex-linked mutant characters of *D. willistoni*, with a chromosome map showing the approximate location of the genes. The characters which show a related or similar resemblance to those of *melanogaster* are noted, yellow and scute being the most pronounced.

Hen feathering induced in the male fowl by feeding thyroid, H. B. TORREY and R. HORNING (*Soc. Expt. Biol. and Med. Proc.*, 19 (1922), No. 6, pp. 275-279).—This paper includes a report of the production of hen feathering in Rhode Island Red cockerels fed from 50 to 330 mg. of 0.2 per cent dried thyroid daily while from 4 to 15 weeks of age, at the University of Oregon. The authors offer several possible explanations for this occurrence, but seem to find very little proof for most of them.

¹ *Natl. Acad. Sci. Proc.*, 7 (1921), No. 8, pp. 225-229.

An undescribed relation of the suprarenals to ovulation, O. RIDDLE (*Soc. Expt. Biol. and Med. Proc.*, 19 (1922), No. 6, pp. 280-282).—By killing 43 female pigeons of fully known reproductive history during different intervals from over 96 hours before ovulation to over 96 hours after ovulation, it was found that in the healthy birds (not infected with tuberculosis or *Ascaridia*) in nearly all cases the suprarenal glands enlarged with ovulation, and they were most enlarged in the middle of the ovulation period.

The chemical composition of animal bodies, J. A. MURRAY (*Jour. Agr. Sci. [England]*, 12 (1922), No. 2, pp. 103-110, fig. 1).—The author has studied the data of Haecker (*E. S. R.*, 44, p. 569) and Swanson (*E. S. R.*, 45, p. 472) and has not only found agreement with his conclusions previously expressed (*E. S. R.*, 43, p. 372), but has suggested formulas by which the average composition of the whole bodies of beef cattle, hogs, and possibly sheep may be calculated provided the live weight and percentage of fat in the body are known. From Haecker's studies of beef cattle it is shown that the percentage of water in the nonfatty dry matter of the body is comparatively constant at a given age (weight), and that the percentage of water gradually decreases as the animal matures, while the percentages of ash and protein are correspondingly increased. The ratio of ash to protein was found to be $1:4.392 \pm 0.215$ without any relationship to age and its variability. This showed that from 79 to 84 per cent of the nonfatty dry matter was protein and that 16 to 21 per cent was ash. The mean percentages of these substances could then be calculated by the formulas

$$P=0.815 (100-W) \text{ and } A=0.185 (100-W)$$

where P, A, and W are the percentages of protein, ash, and water, respectively, in the nonfatty matter. Since the percentage of water in the fat-free body varied with age (weight) the following formula, in which m is the fat-free body weight, was found to calculate the percentage of water (w) in very close agreement with the actual formula

$$w=90m^{-0.0024}$$

In treating Swanson's data on pigs, it was found that the formula for calculating the water in beef cattle was applicable in every way. In the case of the protein and ash formulas, if the factors of 0.815 and 0.185 were changed to 0.83 and 0.17, respectively, more close agreement with the actual was obtained. Different rations were found to have practically no effect on the composition of pigs' bodies, except that ash in the ration tended to lower the protein-ash ratio.

In the case of sheep from Lawes and Gilbert's data (*E. S. R.*, 43, p. 371), the ratio of protein to ash was found to be the same as for cattle, but the coefficient of 90 in the formula for calculating the water had to be reduced to 87.

Comparative determinations of the digestibility and metabolizable energy of green oats and tares, oat and tare hay, and oat and tare silage, H. E. WOODMAN (*Jour. Agr. Sci. [England]*, 12 (1922), No. 2, pp. 144-165).—The author reports the results of experiments from the Institute for the Study of Animal Nutrition at Cambridge University in determining the comparative digestibility and metabolizable energy of oats and tares when green, as hay, and as silage. In making these trials the two wethers used in previous experiments (*E. S. R.*, 46, p. 871) were employed. These tests differed from the previous ones in that no basal ration was fed, the wethers receiving only the oats and tares for feeding periods of three weeks, and the determinations of digestibility and metabolizable energy being made only during the last 14 days.

The following table gives a summary of the amount of feed each wether received, the composition, and the average coefficients of digestibility obtained for each type of feed.

Composition and digestibility of oats and tares.

Kind of feed.	Daily ration.	Dry matter.	Composition of dry matter.				
			Crude protein.	Ether extract.	Fiber.	N-free extract.	Ash
	Gm.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Green oats and tares.....	4,000	32.47	10.83	3.02	28.12	50.22	7.81
Oat and tare hay.....	1,000	83.96	13.90	2.09	29.07	45.81	9.13
Oat and tare silage.....	3,000	27.30	12.55	4.32	29.44	45.57	8.12

Kind of feed.	Coefficient of digestibility.					
	Dry matter.	Crude protein.	Ether extract.	Fiber.	N-free extract.	Ash.
	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Green oats and tares.....	63.7	63.1	51.9	47.6	76.5	42.2
Oat and tare hay.....	65.0	68.2	36.8	58.7	71.3	53.6
Oat and tare silage.....	64.1	65.1	73.4	57.1	70.5	43.7

The nitrogen balances were determined, as well as the weights of the sheep and the metabolizable energy expressed in therms per 100 lbs. of the dry foodstuffs, which were found to be 116.23, 113.1, and 117.23 therms for the green feed, hay, and silage, respectively. Corrections for the coefficients of digestibility of the protein and metabolizable energy of feeds were made, but only the actual uncorrected results are here reported.

West Virginia pastures, I. S. Cook (*West Virginia Sta. Bul. 177 (1922), pp. 24, figs. 4*).—The results of a survey of the carrying capacity of West Virginia pastures (E. S. R., 39, p. 169) are given, followed by a discussion of the effect on the pastures of too heavy grazing, pasturing too early in the spring, and the results of practicing different methods of improvement.

In a pasture renovating experiment four 1-acre plats of permanent blue grass pasture were differently treated in 1913 with fertilizers and seed. The carrying capacity of these plats was determined with sheep during the pasturing seasons of 1914, 1915, and 1916. The grazing was improved on the plats receiving nitrogen, phosphorus, potassium, lime, and clover and grass seed. The application of acid phosphate and seeding with clover resulted in a good growth of clover scattered through the blue grass. Lime alone or lime and grass seed did not increase the grazing capacity.

Some feeding experiments with allegedly poisonous plants, M. HENRY (*Agr. Gaz. N. S. Wales, 33 (1922), No. 5, pp. 341-346*).—Feeding experiments with four supposedly poisonous plants in New South Wales gave negative results in all cases. The experiments consisted of feeding 2 Merino wethers for one month and 2 wethers for 15 days on *Solanum esuriale* and 2 sheep on the berries for 2 days; pasturing 2 3-year-old wethers and 2 head of 20-months-old cattle on Patterson's curse (*Echium plantagineum*) for 24 days; feeding 2 Merino wethers on the leaves and berries of dogwood poison bush (*Myoporum deserti*) for 4 days; and feeding 2 Merino wethers on Sudan (*Swainsona affinis*) and other grasses from February 21 to March 12.

Report of committee on stock feed, J. M. Ross (*Hawaii. Sugar Planters' Assoc. Proc., 41 (1921), pp. 158-181*).—This is the usual annual report (E. S. R.,

45, p. 573) on local stock-feeding conditions, composed mainly of the answers to a questionnaire on feeding horses, mules, dairy cattle, calves, and hogs on plantations in Hawaii. The principal feeds used include hay, barley, molasses, alfalfa, cane tops, and native grasses. Pigeon peas and guinea and elephant grasses are expected to prove valuable substitutes for alfalfa, the latter being difficult to raise.

Cattle feeding experiment No. 9, Government experiment farm, Gwebi, E. A. NOBBS (*Rhodesia Agr. Jour.*, 19 (1922), No. 3, pp. 267-275, pls. 2).—This is an account of the fattening of 60 head of cattle at the Government experimental farm, Rhodesia. The feeds used consisted of veld hay, corn fodder, velvet bean hay, oat hay, Sudan hay, silage, pumpkins, majordas, mangolds, cracked corn, bean meal, peanut meal, sunflower meal, linseed meal, and salt, which were fed in different combinations during the three feeding periods of 50, 56, and 46 days, respectively. The feeds consumed and the weights of the individual animals are given, showing an average gain of 2 lbs. per head per day for the entire test.

Grain sorghums v. corn for fattening baby beeves, J. M. JONES, R. A. BREWER, and R. E. DICKSON (*Texas Sta. Bul.* 296 (1922), pp. 5-25).—After reviewing experiments dealing with the feeding value of the grain sorghums for beef production, a more complete report is given of the test previously noted (*E. S. R.*, 45, p. 873). The baby beeves in lot 1 were all graded as choice to prime; in lot 2, 3 were choice to prime and 12 choice; and in lot 3 all choice. The dressing percentages of the respective lots were 57.35, 56.42, and 57.73 per cent.

Steer feeding [at the Kentucky Station comparing shelled corn with broken ear corn] (*Kentucky Sta. Rpt.* 1921, pt. 1, pp. 22, 23).—Steers receiving a ration of shelled corn, corn silage, cottonseed meal, and straw for 140 days made average daily gains of 1.95 lbs. as compared with daily gains of 1.89 lbs. by steers receiving the same ration with broken ear corn substituted for shelled corn. The cost per 100 lbs. of gain were practically the same, but the lot receiving broken ear corn was valued at 25 cts. more per hundred at the end of the test.

Fattening steers, E. L. POTTER and R. WITCOMBE (*Oregon Sta. Bul.* 193 (1922), pp. 18, figs. 2).—This is a revision of Bulletin 174 (*E. S. R.*, 44, p. 176), with slight changes in some of the average results reported, due to the inclusion of data from experiments carried on between August, 1920, and August, 1922.

Report on sheep breeding experiments (*Brit. Research Assoc. Woollen and Worsted Indus. Pub.* 14 (1922), pp. 15, pls. 6; also in *New Zeal. Farmer*, 43 (1922), No. 6, pp. 733, 734; *abs. in Nature* [London], 109 (1922), No. 2740, pp. 595, 596, figs. 5).—The results of the following experiments are given in the report on sheep breeding experiments by the British Research Association for Woollen and Worsted Industries:

Sheep breeding experiments in Scotland, J. C. Ewart.—After giving a few brief notes on the history of some of the modern breeds of sheep, explaining the origin of some of the different types of wool, the author describes a series of experiments in crossing Highland Blackface sheep with other modern breeds and another series of experiments in crossing primitive breeds of sheep.

In an effort to produce new and improved strains of Highland Blackface sheep, the Duke of Richmond and Gordon in the autumn of 1919 crossed Blackface ewes with a Southdown ram at Gordon Castle Farm, Fochabers, and 15 hybrids were produced in 1920, some of which resembled their parents and

others seemed to revert to previous ancestors. In 1920 and 1921 the F_1 ewes were bred to nonrelated F_1 rams. An average of about 25 per cent of the F_2 s resembled each of the grandparents, and about 50 per cent resembled their parents (F_1 s), although on reaching maturity this resemblance may not be so pronounced. In 1920 70 Blackface, 3 Greyface, 5 Cheviots, and several Soay ewes were mated to Southdown rams and 19 Blackface ewes were mated with a Soay ram. The F_2 s had been bred in 1921. Attempts are also being made at Fochabers to produce a vigorous herd of Peat or Heath sheep.

One hundred Blackface ewes mated with Southdown rams at Auchrae by R. Macmillan in 1920 produced 89 lambs, of which 83 were living in June, 1921, 36 being males and 47 females. About two-thirds of the lambs had dun faces and legs, and the rest had black and white faces. All had a tuft of wool for the forelock as in Southdowns. In coat and color 55 approached the Southdown and 23 the Blackface, the rest being intermediate and spotted. All the ram lambs had horns, but the ewe lambs were hornless.

At Fairburn, Muir of Ord, J. Sterling crossed 150 Blackface ewes in 1920 with Southdown, Soay, and Siberian-Shetland rams. The Southdown-Blackface crosses were similar to those noted above, but the Soay-Blackface crosses were deficient in size and vigor, probably due to the inbreeding of the rams. The crosses from the Siberian-Shetland ram and Blackface ewes were described as very promising. The fact that other similar experiments are being performed is noted, as well as one in which Blackface ewes are being crossed with Kerry Hill rams and one in which Cheviot ewes and Suffolk rams are being crossed.

Sheep breeding experiments in Wales. R. G. White.—Notes are given on several experiments being conducted by the author. In one experiment 2 lots of 20 ewes each were selected from the flock of the University College of North Wales. One lot was selected because of the small amount of kemp in their fleece and the other lot because of the large amount of kemp, and the condition and weight of the different lots after wintering on the mountain were recorded.

Mating a Soay ram in 1919 with Welsh ewes produced 1 black ewe, 1 white ram, 1 sandy ewe (later became white), and 1 white ewe, all of which had short tails and were small. With similar matings in 1920, 3 ram and 3 ewe lambs were produced, all of which were white, short tailed, and small. Three Southdown ewes mated with a Welsh ram in 1920 produced 1 ewe and 2 ram lambs. At the same time the reciprocal cross produced 3 ewes and 4 ram lambs. The ewes were mated with one of the above rams. Twenty cross-bred Southdown-Welsh ewe lambs were also mated in 1920 with a Welsh ram. Due to liver fluke only 8 lambs were reared, which weighed on November 1 from 67 to 87 lbs. The F_2 generation will appear in 1922. The desirable quantities of the F_1 Southdown-Welsh crosses are that the mutton qualities are excellent, kemp is almost entirely eliminated, and the wool is improved in quality.

The report of the joint committee on sheep breeding for the improvement of British wools concludes this work, in which it is mentioned that a new department of animal breeding research has been created at Edinburgh University, under the direction of F. A. E. Crew, which will make studies in sheep breeding and improvement.

Grading up mountain ewes (*Kentucky Sta. Rpt. 1921, pt. 1, pp. 23, 24*).—In an experiment carried on from 1915 to 1921, purebred Hampshire, Southdown, Cheviot, and Rambouillet rams bred to mountain ewes "sired lambs that were more meaty, grew more rapidly, were of finer quality, and dressed out a higher percentage than lambs sired by scrub rams."

One-night camps v. established bed-grounds on Nevada sheep ranges, C. E. FLEMING (*Nevada Sta. Bul.* 103 (1922), pp. 21, figs. 9).—This is a revision of Bulletin 94 previously noted (E. S. R., 39, p. 773).

[Hog feeding experiments at the Kentucky Station] (*Kentucky Sta. Rpt.* 1921, pt. 1, pp. 24, 25).—Pigs receiving fresh buttermilk, with corn meal and shorts, made slightly larger gains than others receiving stale buttermilk in place of the fresh buttermilk. In a second experiment, using shelled corn, the lot receiving the stale buttermilk made slightly the better gains.

Another year's experiments in hogging down corn and soy beans has shown results which are in conformity with those previously reported (E. S. R., 46, p. 874).

Shrinkage of soft pork under commercial conditions, L. B. BURK (*U. S. Dept. Agr. Bul.* 1086 (1922), pp. 40, figs. 3).—This is the report of a series of tests which were carried on with the cooperation of packing houses at Fort Worth, Tex., and East St. Louis, Ill., to study the comparative shrinkage of soft, oily, and firm pork. In making these studies a total of 800 hogs were used, of which the live weights, dressed weights, and weights of parts of the carcass were recorded during curing, smoking, and after holding 19 to 21 days.

The total average shrinkage from chilled weight to the end of the retaining period was 13.85 per cent for both oily and firm pork and 15.92 per cent for soft pork. Though the shrinkage of oily pork was not greater than that of firm pork, the bacon from oily pork remained soft and was difficult to slice, and the lard was liquid and transparent, but smoked shoulders and hams from oily and firm carcasses were indistinguishable after retaining for 10 days.

The test demonstrated that soft, oily, and firm hogs could not be separated on foot.

Breeds of swine, E. Z. RUSSELL (*U. S. Dept. Agr., Farmers' Bul.* 1263 (1922), pp. 22, figs. 18).—Brief descriptions are given of the types and breeds of hogs.

Pig breeders' annual, 1922 (London: Natl. Pig Breeders' Assoc., 1922, pp. 66, figs. 26).—This is the usual pig breeders' annual for 1922, containing various articles of practical interest as follows: Diseases of the Skin, by H. Leeney; Pig Feeding, by W. M. Tod; The Evolution of the Tamworth, Large White and Middle White Pigs, by H. G. Robinson; The Mineral Requirements of the Pig, by J. B. Orr and A. Crichton; Railway Rates on the Conveyance of Pigs, by E. Wherry; Systematic Rationing of Fattening Pigs, by C. Crowther; Pig Breeding in Scotland, by L. MacQ. Douglas; Show Condition and Breeding Capabilities, by S. Spencer; A New Type of Portable Sty, by J. Golding; and The Use of Portable Stys, by S. R. Whitley; as well as pig and pig products statistics.

The influence of inbreeding on the performance of Thoroughbred horses, F. HUFF (*Fühling's Landw. Ztg.*, 70 (1921), No. 3-4, pp. 47-61; *abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr.*, 12 (1921), No. 5, pp. 594-597).—In a study of the effects of inbreeding on the performance records of horses, the author has taken data from a Thoroughbred stud at Waldfried. The animals are classified according to the number of generations in their pedigrees in which there was no inbreeding and as to the amount of money which has been won at the races by these animals.

Studies were made comparing the inbreeding of 52 mares and the racing qualities of their offspring, and the inbreeding and racing qualities of 257 stallions and mares, as well as other studies in which the offspring of single stallions were compared. From the data presented, the author concludes that the inbreeding was without influence on the racing and breeding powers of the Thoroughbreds at Waldfried.

Laying periods in egg production of some wild birds as compared with domestic fowl, D. TOLLENAAR (*Meded. Landbouwschooges.* [Wageningen], 23 (1922), No. 2, pp. 46, pl. 1, figs. 12).—In studying the length of laying period, the eggs laid for each brood, and the number of broods per year of various species of wild birds, data are treated showing the trap-nest records of various species of small birds of the genera *Parus*, *Turdus*, *Erithacus*, etc. The data were collected during the years 1917, 1918, 1919, and 1920, thus showing the influence of food supply and temperature on egg production during the different years.

Only two or three broods of eggs were laid during the season by the wild birds. The beginning of the laying period varies with different species, but the time of beginning was found to be somewhat correlated with the previous 10-day temperature, and more closely correlated with the temperature from January 1 to the time of laying. Early laying was also found to tend toward more broods and more eggs during the successive broods than with a later start. The number of eggs per brood was found to decrease in the second and third broods, but the variability which occurred in the latter broods was increased.

It is concluded that the same principles with regard to seasonal variation applied to the egg production of wild birds as Pearl and Surface previously worked out for the domestic fowl (*E. S. R.*, 31, p. 669). A rather complete abstract in English is included with this article.

Meat scrap in the laying ration (*Kentucky Sta. Rpt. 1921, pt. 1, p. 26*).—Three years' results on feeding laying hens rations containing different amounts of meat scrap indicate that the mash should contain 20 per cent of meat scrap to secure maximum production without forcing the birds (*E. S. R.*, 46, p. 875).

Egg-laying tests at Hawkesbury Agricultural College, twentieth year's results, 1921–22, F. H. HARVEY and J. HADLINGTON (*Agr. Gaz. N. S. Wales*, 33 (1922), No. 5, pp. 363–374, figs. 19).—This is the usual report of the annual egg-laying contest at Hawkesbury Agricultural College, New South Wales, for the year 1921–22 (*E. S. R.*, 46, p. 273).

Effect of confinement and green feed on number and hatchability of eggs, H. ARWOOD (*West Virginia Sta. Bul. 178* (1922), pp. 12).—The results of two years' experiments to study the effect of confinement and green feeds on the number, fertility, and hatchability of eggs are reported in which each year six lots of 15 White Leghorn yearling hens the first year and pullets the second year were selected. Three of the lots were confined in colony houses, whereas the other three lots had access to a yard. All lots received a mash composed of 2 parts corn meal, 1 part each wheat bran, wheat middlings, and meat scrap, and scratch feed consisting of 2 parts corn and 1 part oats.

During the six months of the first experiment, the confined pens consumed 1,653 lbs. of feed and laid 2,668 eggs, weighing an average of 56.03 gm. each, as compared with 1,779 lbs. of feed consumed and 3,873 eggs averaging 57.94 gm. laid by the hens running out. Similar results were obtained for the second test. In five months the confined birds laid 2,556 eggs averaging 51.95 gm. as compared with 3,215 eggs averaging 51.86 gm. laid by the birds running out. Sprouted oats and corn silage were each fed to one confined pen, and they were alternated with no green feed for periods of two months in the pens running out during the first year, whereas in the second year corn silage and beet pulp were each fed for the entire test to one confined pen and one pen not confined. The birds in the first test receiving sprouted oats, silage, and no green feed laid, respectively, 2,222, 2,104, and 2,215 eggs, and in the second test those receiving corn silage, beet pulp, and no green feed laid, respectively, 2,004, 1,940, and 1,737 eggs.

The results of these experiments, as well as two others carried on from 1912 to 1914, indicate that green feeds have practically no influence in the number of eggs produced, but the fertility and hatchability of the eggs were increased by green feeds and not confining the hens. For the pens receiving sprouted oats, silage, and no green feed the first year, 72, 72.78, and 61.98 per cent, respectively, of the eggs incubated hatched, and in the second test 58.8, 58.46, and 56.89 per cent of the eggs hatched from the pens receiving, respectively, silage, beet pulp, and no green feeds. In the first and second tests, respectively, 77.06 and 69.18 per cent of the eggs from pens not confined were hatched as compared with a hatchability of 62.32 and 41.25 per cent for the eggs from the confined pens.

The egg production compared favorably and the hatchability of the eggs was slightly better for two other lots of birds in the second test in which semi-solid buttermilk replaced the meat scrap in the ration.

DAIRY FARMING—DAIRYING.

The protein requirements of dairy cows, J. L. HILLS, C. L. BEACH, A. A. BORLAND, R. M. WASHBURN, G. F. E. STORV, and C. H. JONES (*Vermont Sta. Bul.* 225 (1922), pp. 3-199).—The results of experiments performed from 1906 to 1919 are reported, dealing with the effect of rations containing varying amounts of protein on the weight, condition, quality of milk, and milk production of dairy cows when fed on one ration over long periods of time or when different rations were alternated, also to study the relation of the digestible nutrients in the food and that accounted for in maintenance and milk with reference to the present feeding standards, and to study the changes in milk flow due to advancing lactation, abortion, or abrupt changes in the ration.

Three different rations were fed in the test which were designated as the low, medium, and high protein rations, and after 1914 a very low protein ration was also fed to some of the animals. All rations were calculated as nearly as possible to contain the same amount of ash, digestible crude fiber, and total digestible nutrients and were to supply the same amount of feed to animals of equal production. The distinguishing characteristics of the rations were that the grain mixture in the low protein ration should contain from 9.5 to 10 per cent digestible protein, have a nutritive ratio of 1:8.6, and furnish 1.5 lbs. of digestible protein daily to the average cow yielding 15 to 20 lbs. of milk. The respective characters of the medium protein ration were 15.5 to 16 per cent protein, nutritive ratio of 1:6.4, and 2 lbs. digestible protein; high protein ration 21.5 to 22 per cent protein, nutritive ratio 1:5, and 2.5 lbs. digestible protein; and the very low protein ration 6.5 per cent digestible protein, nutritive ratio 1:11.6, and supply 1 lb. of digestible protein to the average cow daily. In formulating the rations, the feeds used were of necessity different to get the different percentages of digestible protein, but all cows received daily rations of from 20 to 40 lbs. of corn silage and 8 to 20 lbs. of mixed hay, as well as some miscellaneous roughages from time to time. The grain mixtures were made up as follows: Very low protein ration 100 lbs. wheat bran, 100 lbs. ground oats, 300 lbs. corn-and-cob meal, and 100 lbs. hominy feed; low protein ration 300 lbs. wheat bran, 200 lbs. ground oats, and 200 lbs. hominy feed; medium protein ration 300 lbs. wheat bran, 175 lbs. ground oats, 100 lbs. gluten feed, and 125 lbs. cottonseed meal; and high protein ration 200 lbs. wheat bran, 100 lbs. ground oats, 200 lbs. cottonseed meal, and 200 lbs. linseed meal.

The amount of grain fed each cow depended on the milk solids she produced. Only one-half of the regular amount of grain was fed when pasture was good during the spring and early summer. The high, medium, and low protein

rations were fed according to three different methods, each ration being fed to one group of cows continuously over several lactation periods as long as it was possible to maintain them in the experiment (long continuous group). With other groups of cows the rations were alternated with lactation periods (lactation alternation group), and other cows, which were mostly too old or too young for the above groups, received rations which were alternated every 5 weeks during the winter-feeding period. The very low protein ration was fed only to long continuous and lactation alternation groups.

At the start of the test there were 21 cows in each of the long continuous, lactation alternation, and short alternation groups, which were divided to receive the different rations. Due to injury or necessity, some cows were removed and others added as they became available from time to time. Records were kept on a total of 105 different cows, which for the long continuous trials included 170 lactation periods, for lactation alternation trials 153 lactations, and for the short alternation periods 127 different groups fed during 3 to 6 5-week periods. Data collected during the test included records of the milk produced and feed consumed, which were regularly analyzed, live weights, physical condition of the animals, and dates of calving and going dry, as well as a mass of other material. The data reported have been computed in several different ways for the entire year and for the winter months to make the results more certain.

In discussing the effect of the different rations on milk production, the author concludes that the medium protein ration produced practically as much milk as the high protein ration, that the low protein ration produced 95 per cent as much as the above, and that the very low protein ration seemed almost as effective as the low protein ration for milk production. The following table shows the nutrients consumed and the milk produced daily, as well as the average live weight of cows on the different rations for the entire year:

Average live weight, daily milk produced, and nutrients consumed during the year by the cows on the different rations.

Protein ration	Live weight.	In daily feed consumed.		Daily production.		
		Total digestible nutrients.	Digestible protein.	Milk.	Total solids	Butter fat.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Low.....	894	11.80	1.26	17.0	2.41	0.84
Medium.....	906	11.70	1.04	16.4	2.38	.85
High.....	896	12.00	2.09	17.4	2.47	.86
Very low.....	831	9.35	.75	14.9	2.21	.79
Low ¹	872	10.15	1.02	16.5	2.33	.80

¹ Records after 1914 comparable with feeding of very low ration.

The rations containing the larger amounts of protein seemed to be better producers of live weight, though the low-protein ration was ample to hold or increase the weight of growing animals. "Aside from the fact that the cows fed the very low protein ration for several years were somewhat more spare in flesh as a result, their bodily vigor and serviceability did not seem to be affected." The composition of the milk was in no way affected by the different rations except in casein and albumin content, which seemed to vary slightly with the protein content of the ration.

"Disregarding the effect on the continued physical well-being of the animal which might result from long continued usage of, for example, a very restricted

ration, the short alternation trials gave results which were not materially unlike those afforded by the long-time experiments."

Cows served three months after calving yielded during the first nine months approximately nine-tenths of the milk flow of the previous months, and during the tenth to twelfth months five-sixths of the milk flow of the previous months. Abortion was found to cause an average reduction of 22 per cent in milk yield. Based on 304 weekly records preceding and following abrupt changes in the ration, increases in protein tended to retard the normal decrease in milk flow estimated at 2 per cent per week, whereas the opposite change made an added decrease of about 1 per cent. The results of this test tended to substantiate the feeding standards which recommend the smaller amounts of protein.

A summary of the literature of protein usage by dairy cows is also given.

[Studies in production, inheritance, and growth in dairy cattle at the Kentucky Station] (*Kentucky Sta. Rpt. 1921, pt. 1, pp. 30-32*).—Studies of the influence of age and pregnancy on production from records in the Register of Merit of Jersey cattle showed that open cows slightly exceed pregnant cows in production, and that 2-year-olds produce 73 lbs., 3-year-olds 81, 4-year-olds 94, 5-year-olds 92, and 6-year-olds 96 lbs. of butter fat compared with 100 lbs. for 7-year-olds. Other studies have failed to show any correlation between the size or shape of the escutcheon, the amount or color of body secretions, and the yield of milk or butter fat. The Selvege type of escutcheon was found most common in Jerseys, whereas the Flandrine type is most common in Holsteins, Guernseys, Ayrshires, and Kerrys.

Of the Jersey cattle studied, 66 per cent were found to be solid in color and have black tongues and switches, whereas 12 per cent were broken colored with white tongues and white switches. Of the solid colored individuals 89 per cent had black tongues and switches, whereas 71 per cent of the broken colored cattle had white tongues and switches.

Six Jersey heifers averaging 32.8 in. in height at six months of age had gained 15.1 in. at 4½ years of age, 11.1 in. of which was due to deepening of the chest and 4 in. to a lengthening of the legs.

Who's who among Holstein-Friesian sires, R. E. HUNT (*Holstein-Friesian World, 19 (1922), Nos. 31, pp. 13-15, 28, 30, 32; 32, pp. 38, 30-32*).—The study previously reported (*E. S. R., 47, p. 279*) is revised to date by including the records reported in volume 32 of the Holstein-Friesian Advanced Registry.

Is midday milking profitable? J. NILSSON (*Valmø, Låns HushdU. Sällsk. Kvitaskr., 1922, No. 1, pp. 62-72, fig. 1*).—The author reports the results of tests with 75 high and medium producing cows at four different farms to determine whether milking at 9.30 to 10.30 in the morning increased the milk and fat production of high and medium producing cows that were milked at 4 to 4.30 a. m. and 4 to 5.30 p. m. sufficiently to warrant the extra milking. For cows producing over 20 kg. (44 lbs.) of milk per day the midday milking increased their production by an average of 1.6 kg., but for cows producing from 12 to 20 kg. there was an average daily increase of only 0.3 kg. The average fat percentage of the milk was practically the same in either case. From an economic viewpoint the author concludes that the midday milking would not pay unless the cows gave over 14 kg. of milk per day.

The relation of fat to fat-free dry matter in milk, F. REISS (*Milchw. Zentbl., 51 (1922), No. 11, pp. 121-124*).—Analyses of milk samples are presented which show that the fat in milk is not necessarily an indication of the other nutrients, since they may or may not vary in proportion to the amount of fat.

An analysis of camel's colostrum, H. L. FALES (*Jour. Biol. Chem., 53 (1922), No. 2, p. 339*).—A sample of camel's colostrum, taken two days after

parturition, was described as thick, rich, and creamy white, with less taste and odor than cow's milk, showing an amphoteric reaction to litmus, and having a specific gravity of 1.038. The milk contained 7.4 per cent of fat, 4.2 per cent of sugar, and 5.4 per cent of protein consisting of 4.1 per cent of casein, 0.5 per cent of albumin, and 0.8 per cent of globulin. The ash content was reported as 0.893 per cent.

On abnormal milk and on the influence of an aseptic udder inflammation on the composition of the milk, B. SJOLLEMA and J. E. VAN DER ZANDE (*Jour. Biol. Chem.*, 53 (1922), No. 2, pp. 513-530).—A study of abnormal milk similar to the one previously noted (E. S. R., 47, p. 784) is reported, in which analyses of milk from aseptic inflamed udders were made. The changes were found to compare closely with those changes which occur with septic inflammation due to streptococci. An aseptic abscess in the region of the neck due to an injection of turpentine was found to have a very slight influence on the composition of the milk.

Removal of garlic flavor from milk and cream, S. H. AYERS and W. T. JOHNSON, JR. (*Ice Cream Rev.*, 5 (1922), No. 11, pp. 60, 62, fig. 1).—Experiments are reported in which it has been possible to remove onion or garlic flavor from milk and cream by heating the milk to 145° F. and blowing air through it for 30 to 60 minutes. While the air is being blown through it, the milk is pumped into another tank having a perforated bottom, through which it runs back into the original container.

Creamery inspection in New Jersey, F. C. BUTTON (*New Jersey Stas. Oirc.* 143 (1922), pp. 16, figs. 2).—This is the usual report of creamery inspections in New Jersey for the year ending June 30, 1922 (E. S. R., 47, p. 180).

Bacterial content of butter, G. D. TORRE (*Ann. Ist. Sper. Caseif. Lodi*, 1 (1922), No. 2, pp. 55-70).—Bacterial counts of five samples of butter are given as determined by cultures made on gelatin and agar media. These samples varied from 36,200 to 7,360,000 bacteria per gram of butter. The variation was attributed to differences in the temperature and length of time at which the milk was stored and the methods of manufacturing the butter.

Standardization of rennet extracts, R. H. LEITCH (*Scot. Jour. Agr.*, 5 (1922), No. 3, pp. 292-299, fig. 1).—Due to the variation in the time required to coagulate milk with rennet and the difficulties which thus occur in making an effort to standardize rennet, the author suggests the use of reconstructed milk powder for testing rennet.

Pasteurization of whey and buttermilk or testing all cattle necessary to protect hog markets, J. P. NORGORD (*Butter, Cheese, and Egg Jour.*, 13 (1922), No. 35, pp. 36-38).—This is a discussion of the importance of pasteurizing whey and buttermilk used for hog feeding because of the prevalence of tuberculosis in hogs, partly at least attributed to milk from tubercular cattle. Pasteurizing whey and buttermilk was found to be an advantage to the creamery because of the assistance it rendered in keeping the cans and other utensils free from bacteria and molds.

A simplified method of instruction in standardization of the ice cream mix, N. E. OLSON (*Ice Cream Rev.*, 5 (1922), No. 9, pp. 6, 8, 10).—The author suggests a method of standardizing the ice cream mix for the special benefit of the beginner.

Calculating the ice-cream formula, W. B. COMBS and W. H. MARTIN (*Ice Cream Trade Jour.*, 18 (1922), No. 8, pp. 44-46).—An algebraic method of calculating the ingredients of the ice-cream mix is described.

VETERINARY MEDICINE.

Studies on complement fixation.—VI, **The velocity of fixation of complement with bacterial antigens**, R. L. KAHN and S. R. JOHNSON (*Jour. Infect. Diseases*, 31 (1922), No. 5, pp. 416-425, figs. 6).—The studies reported in an earlier paper of the series (E. S. R., 46, p. 276) have been extended to determinations of the velocity of fixation of complement at different temperatures with the following bacterial antigen antibody complexes: *Bacillus abortus* with specific bovine serum and *B. typhosus*, *B. paratyphosus* A and B, *B. mallei*, and *B. pullorum* with specific rabbit serum. The fixation periods were 0.5, 15, and 30 minutes and 1, 2, 3, 4, 5, and 6 hours, and the temperatures room, water bath, and ice box.

With the exception of *B. pullorum*, the various reactions were similar in that the velocity of complement fixation was practically the same at the different temperatures and that a fixation period of 4 hours at ordinary ice-box temperature was superior to a 1-hour period in the water bath, the latter proving insufficient for complete fixation and too high a temperature for preservation of the complement. It is emphasized, however, that while the ice-box fixation is undoubtedly superior in most cases to the water bath, the period of fixation should be judged in each case by preliminary titration for different lengths of time, and that this preliminary test should include the use of different concentrations of serum. "The numerous ways of preparing bacterial antigens combined with the varying complement fixation procedures employed by different workers, in our opinion, necessitates this step until we learn more of the laws governing the phenomenon of complement fixation."

Studies on complement fixation.—VII, **The determination of the optimum amount of antigen in complement fixation tests**, R. L. KAHN and S. R. JOHNSON (*Jour. Infect. Diseases*, 31 (1922), No. 5, pp. 426-437).—In this continuation of the above series, the authors discuss the present methods of titrating antigen for complement fixation tests and suggest that they are based on the wrong assumption that the greater the concentration of antigen the stronger the reaction, while the aim should be to find the amount of antigen which will give reactions of high sensitiveness with weakly positive serums. The experimental work reported consisted principally of the quantitative reaction between serum and antigen in complement fixation tests with three Wassermann and three bacterial antigens, namely, *Bacillus abortus*, *B. mallei*, and *B. typhosus*.

The data obtained with the syphilitic serums confirm the suggestion that there exists an optimum range of antigen which will give complement fixation tests of high sensitiveness with comparatively weak serums, and that the employment of excessive amounts of the antigen may render weak reactions negative. With the bacterial antigens and specific immune serums a similar optimum range of fixation for these tests could not be demonstrated. It is considered, however, that there is no advantage in employing excessive amounts of bacterial antigen, and that unnecessarily large amounts of antigen may lead to nonspecific absorption of complement.

The influence of age and temperature on bacterial vaccines, W. F. HARVEY, K. R. K. IYENGAR, and S. R. CHRISTOPHERS (*Indian Jour. Med. Research*, 8 (1921), No. 4, pp. 715-727).—In this investigation the authors have studied the effect of temperature and age upon typhoid and cholera vaccines as determined by the agglutination reaction of the blood serum of pigeons following the injection of vaccine which had been kept for different periods of time at

room temperature (from 10 to 20° C.) and at 37°. The typhoid vaccine was sterilized by heating for 1 hour at 53° and by the subsequent addition of 0.5 per cent phenol, and the cholera vaccine by the simple addition of 0.5 per cent phenol. The change in appearance of the vaccines with age and exposure was also studied by measuring the turbidity in a tinturometer.

There was no change in the agglutination response to either vaccine during the entire period of 48 weeks and for the various temperatures employed. The cholera vaccine showed a rapid loss in measurable turbidity at first, but did not undergo any rapid change later. There was no appreciable change in the turbidity of the typhoid vaccine.

Some antigenic relations of the bipolaris septicus group of bacteria. L. M. RODERICK (*Jour. Infect. Diseases*, 31 (1922), No. 4, pp. 313-325).—With a view to determining the specificity of various strains of the bipolaris septicus group, an investigation was conducted at the North Dakota Experiment Station on the specificity, as determined by the complement fixation test against cultures isolated from various hosts, of serums from rabbits in which only a single culture strain was used for each rabbit. The serums were prepared by the usual processes of immunization, first by subcutaneous injections of increasing doses of dead organisms, and later with subcutaneous and intravenous injections of live cultures. The cultures used included two each of bovissepticus, sulsepticus, ovisepticus, and avisepticus and one of rabbit septicemia. For the complement fixation tests preliminary titrations were made with increasing quantities of antigen against a constant quantity of serum. For the final quantitative titration from two to six times (usually three times) the antigenic dose, as shown by the preliminary titration, was tested as a constant against decreasing quantities of the serum. The data obtained were analyzed by calculating the average quantities of a serum which were just sufficient to produce fixation with the various culture antigens.

This analysis showed that the average amount of ovisepticus and avisepticus serum necessary to produce fixation in 36 titrations with bovissepticus and sulsepticus cultures was 0.054 cc., while in 43 titrations with ovisepticus and avisepticus cultures an average of only 0.0087 cc. was required. Similarly, with bovissepticus and sulsepticus serums the average amount of the serum in 43 titrations with ovisepticus and avisepticus cultures was 0.083 cc. and in 42 titrations with the homologous cultures only 0.018 cc.

A repetition of part of this work by the Bureau of Animal Industry, U. S. D. A., gave similar results. In 35 titrations of ovisepticus and avisepticus serum with bovissepticus and sulsepticus cultures 0.0475 cc. of serum was required for fixation, while with homologous cultures only 0.0197 cc. was required. Similarly, with bovissepticus and sulsepticus serums the average amount of serum in 44 titrations with ovisepticus and avisepticus cultures was 0.046 cc. and with homologous cultures 0.0308 cc.

These differences are thought to indicate that there are two types of the bipolaris septicus organism, a bovine-swine type and an ovine-avian-rabbit-cavia strain. The latter type is considered to be the more pathogenic and the former the more saprophytic.

Report on the veterinary service of Saxony for 1920 (*Ber. Veterinärw. Freistaat Sachsen*, 65 (1920), pp. V+220).—This is the usual annual report (E. S. R., 46, p. 479).

Experimental studies on foot-and-mouth disease made at the Royal Farm of Poggia a Cajano, near Florence. G. Cosco and A. Aguzzi (*Vet. Jour.*, 78 (1922), No. 568, pp. 372-378).—It has been established "(1) that the pulp of certain lymphatical ganglia, inoculated subcutaneously, is virulent;

thus an attenuated clinical form of the disease with quite particular characteristics would be reproduced in oxen. The pulp of the spleen, inoculated subcutaneously, is also virulent, and causes in oxen a form apparently more serious than that which is reproduced with the blood virus."

The cutaneous lesions of rinderpest and the rôle of hides in the transmission of the disease, G. CURASSON (*Rec. Méd. Vét.*, 97 (1921), No. 1, pp. 19-26; *abs. in Trop. Vet. Bul.*, 9 (1921), No. 3, pp. 169-171).—The author gives a detailed description of the lesions observed in a recent large outbreak of rinderpest in West Africa. He is of the opinion that the importance of hides as a source of infection has been exaggerated. It is claimed that no case of cattle plague in French West Africa has been definitely traced to contagion from the hides of infected animals, and it seems probable that the infective period of hides is short and the danger of their spreading the disease small unless they are transported immediately after flaying a fresh carcass.

Camel surra, H. E. CROSS and P. G. PATEL (*Punjab Dept. Agr., Vet. Bul.* 8 (1922), pp. 19, fig. 1).—This account includes the results of investigations of camel surra conducted by the authors. Their experiments have shown that the new species *Ornithodoros crossi* is capable of transmitting the disease to healthy animals 67 days after feeding on an infected surra animal—though not prior to 47 days—indicating a development of the trypanosome within the tick. It is thought that the fact that this new species of *Ornithodoros* is capable of transmitting surra after a long interval between feeding on an infected animal and a healthy animal may account for surra breaking out yearly or periodically in the same stables and in the same districts though cases of surra have not been imported into these stables or districts. Through the agency of these ticks the disease may be carried over from year to year. When an animal becomes infected through the agency of ticks, the disease can be rapidly spread by direct transmission through the agency of certain tabanids.

Hints on matters connected with the management of dipping tanks (*Mauritius Dept. Agr., Gen. Ser., Bul.* 22 (1921), Eng. ed., pp. 8).—These hints deal with the rectification of the strength of solution in dipping tanks, the oxidation of arsenites to arsenates in dipping solution, the disposal of used solution from dipping tanks, and the treatment of accidental cases of arsenical poisoning in stock.

On the identity of *Ascaris lumbricoides* and *A. suilla*, C. R. BAKKER (*Tijdschr. Vergelijk. Genesk.*, 6 (1921), No. 3, pp. 160-230, pls. 6, figs. 5).—The author's studies, here reported at length and supported by complement fixation tests, have led to the conclusion that the two forms represent a single species, the name *A. lumbricoides* being applicable to the parasite of swine as well as to that of man. A bibliography of three pages is included.

The *Ascaris* of cattle, J. W. S. MACFIE (*Ann. Trop. Med. and Parasitol.*, 16 (1922), No. 3, pp. 311-313, figs. 2).—This is an account of an *Ascaris* received from Kumassi, in the Gold Coast, which differs in certain important points from *A. vitulorum* Goetz as described by Ransom (*E. S. R.*, 25, p. 387).

Bacteriology and pathology of sterility in cattle, D. C. BEAVER ET AL. (*Minnesota Sta. Tech. Bul.* 5 (1922), pp. 5-91, pls. 12).—In this work the authors first discuss the development and the anatomy of the genital tract of the cow and the physiology of reproduction. Then follows a classification and a general consideration of sterility. Under the heading of The Present Investigation, the authors discuss methods of study and report in detail 19 cases investigated.

A careful study of the cases shows the organisms most important in infections of the genital tract of the sow to be streptococci and *Bacillus pyogenes*,

these types being responsible for the greater number of infections. "In all cases of severe nonspecific metritis and other suppurative processes about the genitalia, *B. pyogenes* combined with streptococci, or the latter alone, have been isolated. Other organisms are not regarded as playing a primary rôle. Unless the bacteriologic study is made during the progress of active infection, these types as well as others will most often not be found. In such cases one views only the results of infection, the active process having subsided. It is for this reason that in nearly all cases when no gross evidence of active inflammation exists the genital tract is sterile. The vagina, cervix uteri, and corpus uteri must be excepted.

"Organisms are not normally harbored as commensals in the internal genitalia of the cow, with exceptions as already made. . . . Hydrosalpinx, the end result of active inflammation, existed, cultures from which were sterile. . . . Many other examples of a bacteria-free genital tract may be found in the case reports. . . . The absence of *B. abortus* (Bang) supports the previous view that it is not found in puerperal infections that persist for any length of time, and that it does not persist, so far as is known, in the genitalia of the cow. *B. abortus* was not isolated from any of the cases studied."

It is pointed out that the theory of infection does not explain all cases of sterility. Where no evidence of infection, past or present, exists and the animal is sterile, the ovaries must be looked to as the cause of the condition except, of course, where malformation of the genitalia exists.

A bibliography of 64 titles is included.

Abortion disease in Wyoming. C. ELDER (*Wyoming Sta. Circ.* 18 (1922), pp. 6).—This is a popular summary of information on infectious abortion, with information on the treatment of cows that have aborted.

The relation between the accumulation of globulins and the appearance of agglutinins in the blood of newborn calves. M. L. ORCUTT and P. E. HOWE (*Jour. Expt. Med.*, 36 (1922), No. 3, pp. 291-308).—Data are reported on the agglutination titer and the distribution of proteins in the blood of calves before and after the ingestion of colostrum, the agglutination titer of which was also determined.

The data presented show that the agglutinins which the newborn animal acquires by the ingestion of colostrum are associated with the direct absorption of the globulins of the colostrum. "Whether or not agglutinins can be obtained and absorbed independent of the globulins we do not know, but it appears doubtful from the work of investigators who have studied the chemistry of immunity."

Further evidence of association of agglutinins with globulins is presented in data obtained in the fractional precipitation with sodium sulphate of the proteins of colostrum and of serum with high agglutination titer for *Bacillus abortus*. The protein, or protein mixture, precipitated up to and including 16.4 per cent of sodium sulphate was found to carry with it the agglutinins, a large proportion of which is absorbed by the fraction precipitated by 14.2 per cent sodium sulphate, euglobulin (E. S. R., 47, p. 715). As shown in a previous study (E. S. R., 47, p. 463), this fraction is absent from the blood of a newborn calf until after it has ingested colostrum.

Cow serum as a substitute for colostrum in newborn calves. T. SMITH and R. B. LITTLE (*Jour. Expt. Med.*, 36 (1922), No. 4, pp. 453-468).—The indication that the immunity to *Bacillus abortus* of calves receiving colostrum is due to protective antibodies accumulating in the colostrum up to the time of parturition suggested the hypothesis that similarly the blood of the lactating cow should also contain these antibodies and in this case might serve as a substitute

for colostrum for the protection of calves. To test this hypothesis three groups of 5 calves each were treated with the blood serum of the same cow, one group receiving the serum by intravenous and subcutaneous injection, one by similar injections and also in the milk of the first two meals, and one in the milk of the first two meals. The details of the experiment are given in notes concerning the individual animals in each series.

In the first group receiving the serum by injection, 2 of the 5 animals lived, in the second group all lived, and in the third 3. In discussing these results in connection with those reported in the preceding paper, attention is called to the fact that in the animals which died the internal organs were free or nearly free from *B. coli* and other intestinal types, showing that the serum had exerted a protective action similar to colostrum. The fatal cases following either colostrum or serum treatment are explained as due to either incomplete protection of the intestinal tract or imperfect digestive mechanism. Among the serum-treated calves which survived and were kept from 2 to 8 weeks before being killed joint lesions were practically absent.

Bulbar paralysis in cattle due to the action of a toxicogenic bacillus, with a discussion on the relationship of the condition to forage poisoning (botulism). H. R. SEDDON (*Jour. Compar. Path. and Ther.*, 35 (1922), No. 3, pp. 147-190, figs. 8).—The author reports at length studies of a peculiar paralytic disease of cattle which has occurred almost epizootically in Victoria, Australia, from time to time, usually in midsummer or early autumn, having been most prevalent from 1896 to 1912. The studies, with the details of experiments with animals presented in an appendix, are summarized as follows:

"From the bones of an animal that had died of Midland cattle disease in Tasmania an anaerobic toxicogenic bacillus has been isolated. The toxin of this organism has been found capable of inducing symptoms of the natural disease. These symptoms correspond closely with those due to *Bacillus botulinus* (where massive doses of the latter have been employed), but the organism now described differs in its morphology and certain cultural characters from *B. botulinus*. The name *B. parabolulinus* is therefore proposed for it.

"Midland cattle disease seems to be identical with the disease termed 'impaction paralysis' in Victoria and 'dry bible' in South Australia, and also with 'lamziekte' of South Africa. The last disease is considered by Thielér [E. S. R., 28, p. 780] to be due to a bacterial toxin (analogous to, but not identical with, botulinus toxin) produced by saprophytic bacteria in certain carcasses undergoing putrefaction. No description of this organism being yet available, its relation to *B. parabolulinus* can not be stated, but it would seem probable that they are identical.

"From the fact that the toxin of *B. parabolulinus* has been found capable of inducing symptoms of forage poisoning in horses (natural disease and experimental botulism), it is concluded that it may be a cause of that condition, and possibly is the cause acting in Australia. The toxins of both *B. botulinus* and *B. parabolulinus* lead to bulbar paralysis. The relationship of botulism and parabolulism in cattle and horses is discussed."

A list of 25 references to the literature is included.

Hog cholera: Its nature and control. R. R. BIRCH (*New York: Macmillan Co.*, 1922, pp. X+311, figs. 20).—This is a work by the professor in charge of the New York State Veterinary College Experiment Station, Ithaca, N. Y.

The several chapters deal with the subject as follows: History and economic importance (pp. 1-6); nature and cause of hog cholera (pp. 7-16); methods

of dissemination (pp. 17-20); complications (pp. 21-34); symptoms and lesions (pp. 35-57); diagnosis, differential diagnosis, prognosis (pp. 58-75); preparation of antihog-cholera serum and hog-cholera virus (pp. 76-117); methods of using antihog-cholera serum (pp. 118-157); handling hog cholera in the field (pp. 158-196); hog cholera, meat inspection, and garbage feeding (pp. 197-229); and control and eradication of hog cholera (pp. 230-246).

Sarcosporidiosis of swine, associated with advanced degenerative changes in the musculature, G. T. GREECH (*Jour. Amer. Vet. Med. Assoc.*, 61 (1922), No. 4, pp. 383-392, figs. 4).—The author gives a description of cases examined, their histological appearance, a discussion of the causes of alterations in the affected musculature, frequency of occurrence in swine, and importance from a meat-inspection standpoint.

The occurrence of ancylostomes resembling *Necator americanus* amongst domestic pigs in Amazonas, R. M. GORDON (*Ann. Trop. Med. and Parasitol.*, 16 (1922), No. 3, pp. 295, 296).—Of 15 domestic pigs examined for ancylostomes in Amazonas, Brazil, 75 per cent showed an infestation with what is in all probability *N. americanus*. The author concludes that such a high proportion of infection would indicate that, at least in this locality, the pig plays a part of some importance in the spread of ancylostomiasis.

Equine piroplasmosis in Italy, M. CARFANO (*Clin. Vet., Rass. Polizza Sanit. e Ig.* [Milan], 45 (1922), No. 5, pp. 187-203, figs. 7).—The blood of a horse which has recovered from nuttalliosis is infective for a susceptible animal, while the blood of a horse recovered from babesiosis is not. Similar results are obtained when the blood of an animal recovered from a double infection is used. In Italy the geographical distribution of nuttalliosis, which is transmitted by *Rhipicephalus bursa*, is much greater than that of babesiosis, transmitted by *Margaropus annulatus*.

Canine piroplasmosis, A. MARTIN and R. LASSERRE (*Rev. Vét.* [Toulouse], 73 (1921), Nos. 9, pp. 521-530; 11, pp. 657-671, pls. 2; abs. in *Ann. Méd. Vét.*, 67 (1922), No. 1, pp. 19-22).—A brief account is given of this disease.

Experimental botulism in dogs, R. GRAHAM and S. ERIKSEN (*Jour. Infect. Diseases*, 31 (1922), No. 5, pp. 402-406).—Evidence is presented that dogs are susceptible under certain conditions to type A botulinus toxin but not to type B. Unfiltered type A toxin proved fatal when administered subcutaneously in doses of 0.1 cc. or more, but large amounts (100 cc.) of the same toxin caused illness and death only in dogs from which food had been withheld for 48 hours. Type A spores detoxicated by washing and heating were without effect when injected subcutaneously. The internal organ and muscle tissues of horses and dogs which had died of type A botulism were consumed by dogs without ill effects. Type A antitoxin apparently protected dogs against lethal amounts of toxin.

No symptoms of botulism were induced in dogs by the intravenous or subcutaneous injection of unfiltered type B toxin in liberal amounts. It is concluded that dogs are satisfactory animals for differentiating A and B botulinus toxins by subcutaneous injection.

The diseases of the dog and their treatment, G. MÜLLER (*Die Krankheiten des Hundes und Ihre Behandlung*. Berlin: Paul Parey, 1922, 3. ed., rev., pp. XII+513, figs. 223).—This is a revised edition of the author's work on diseases of the dog.

Spontaneous encephalomyelitis of rabbits, and its relation to spontaneous nephritis, etc., C. C. TWORT and H. E. ARCHER (*Vet. Jour.*, 78 (1922), No. 568, pp. 367-372).—"A good proportion, 10 to 20 per cent, among certain stocks of rabbits suffer from a spontaneous encephalomyelitis. The same may

be said as regards the advent of spontaneous nephritis. It is possible that these two conditions are occasioned by a single virus, almost certainly a filter passer. The disease, while usually benign, may become suddenly virulent and lead to a high mortality. As with distemper of dogs, the disease is often more easily transmitted by cage infection than by artificial inoculation. Death would, in some cases, appear to be due rather to the renal than to the nervous lesions. In fatal cases the blood urea may be high and the urea concentration of urine low. There may be also albuminuria. There may be marked variations in the lipase content of the blood."

Venereal spirochetosis in American rabbits, H. NOGUCHI (*Jour. Expt. Med.*, 35 (1922), No. 3, pp. 391-407, pls. 4).—This is a report of studies of a disease of the rabbit due to a spirochete, referred to as *Treponema cuniculi*.

Poultry diseases, including diseases of other domesticated birds, with a chapter on the anatomy of the fowl, B. F. KAUPP (*Chicago: Alexander Eger*, 1922, 3. ed., rev. and enl., pp. 342, figs. 134).—This is a revised and enlarged edition of the work previously noted (*E. S. R.*, 30, p. 393).

Davainea proglottina, a pathogenic cestode, in American poultry, H. CRAWLEY (*Jour. Amer. Vet. Med. Assoc.*, 61 (1922), No. 3, pp. 305-310, figs. 6).—The author reviews the literature relating to this parasite and reports observations of its occurrence and effect upon fowls in Pennsylvania.

Ipecac in the treatment of blackhead in turkeys, H. W. GRAYBILL (*Jour. Pharmacol. and Expt. Ther.*, 20 (1922), No. 2, pp. 115-119).—The curative effect of ipecac reported by Wegeforth and Wegeforth at San Diego, Calif. (*E. S. R.*, 45, p. 386), led to the experiments here reported. The results obtained by the author failed to confirm those of Wegeforth and Wegeforth, who, however, used turkeys considerably older. The mortality of approximately 50 per cent in the author's tests indicates that ipecac has slight if any value in the treatment of blackhead.

RURAL ENGINEERING.

Hydraulics, H. W. KING and C. O. WISLER (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd.*, 1922, pp. VII+237, figs. 133).—This book deals with the fundamental principles of hydraulics and their application in engineering practice. While many formulas applicable to different types of problems are given, the purpose is rather to bring out clearly and logically the fundamental principles which form the basis of such formulas rather than to emphasize the importance of the formulas themselves. Chapters are included on principles of hydrostatic pressure, pressure on surfaces, immersed and floating bodies, relative equilibrium of liquids, principles of hydrokinetics, flow of water through orifices and tubes, flow of water over weirs, flow of water through pipes, flow of water in open channels, and hydrodynamics.

Irrigation: Its relation to crop yields, soil, and "brak" (alkali), H. W. TURNER (*Union So. Africa Dept. Agr. Jour.*, 5 (1922), No. 2, pp. 153-163).—General information is given on the need for irrigation in South Africa, water requirements of crops, and more especially on the effect of water on the soil, water and crop relationships, and alkali and irrigation relationships. The discussion is based largely on the results of studies at some of the State experiment stations in the arid regions of the United States.

Tests of drainage pumping plants in the Southern States, W. B. GREGORY (*U. S. Dept. Agr. Bul.* 1067 (1922), pp. 54, pls. 2, figs. 9).—This bulletin contains a short description of the various types of drainage pumping plants found in the southern coast country, and gives the results of tests thereof that have been made since 1909 by the Division of Agricultural Engineering of the Bureau of Public Roads. The different types include drainage wheel, chamber wheel,

centrifugal, and screw pumps, using steam and internal-combustion engines and electricity as power. The tests are given in detail, together with data on the cost of operation of plants.

It is shown that the cost decreases as the size of the project increases. The average cost per acre of operating a pumping plant for a project of 3,000 acres was approximately \$1 per acre per year more than for a project of 7,000 acres. The most expensive plants for projects containing 2,400 acres or more were the steam plants with slide-valve engines. There is little choice between the simple Corliss engine and the compound condensing type, the former having a slight advantage for projects of more than 5,000 acres and the latter being a little cheaper for projects of from 2,000 to 5,000 acres. The cheapest plant of all operates by internal-combustion engines, and the difference in various plants depends quite largely on the cost of fuel.

Soft water for the farm, H. R. WALKER (*Kans. Agr. Col. Ext. Bul. 38* (1922), pp. 10, figs. 3).—Practical information on the design and construction of cisterns and cistern filters for the clarification and storage of rain water is presented in this bulletin.

Durability of cement drain tile and concrete in alkali soils: Third progress report (1919-20), G. M. WILLIAMS ET AL. (*U. S. Dept. Com., Bur. Standards Technol. Paper 214* (1922), pp. 463-494, pls. 4, fig. 1).—In the third progress report of this cooperative investigation (*E. S. R.*, 39, p. 86), the results of inspection in 1919 and 1920 of experimental drain tile and concrete block installations at eight alkali-bearing projects in the West are presented.

These indicate again that materials of good quality and proper workmanship are of great importance in the production of concrete which is to be exposed to alkali soils and waters. The action noted on surfaces of concrete blocks of the best quality after one year of exposure in sulphate waters has in most cases been progressive, depending upon the conditions of exposure. The extent and rapidity of disintegration in sulphate waters were found to depend upon the concentration of the salts in the waters to which the concrete was exposed. In blocks containing reinforcing rods disintegration appeared to be aided and accelerated in some cases by corrosion of embedded steel and consequent cracking of the concrete.

Disintegration was found to be brought about only by those salts which are in solution. For the same concentration of soluble salts and for the same aggregates, the resistance of mass concrete to alkali action appeared to vary with the cement content or richness of mixture.

The conclusion is drawn that alkali salts are not uniformly distributed throughout the soil or large bodies of seepage waters, and it will be difficult to determine in advance the concentrations to which a structure may later be exposed. A systematic scheme for sampling soils should furnish information as to the quantities and types of salts available for solution, while analyses of seepage waters should indicate the concentrations present at the time of sampling.

It is further concluded that seepage waters and alkaline soil conditions may be encountered which will disintegrate concrete of the best quality.

In the investigations of cement drain tile it was found that the use of concrete tile in soils containing alkali salts of the sulphate type in considerable quantities is hazardous, since the best quality of drain tile were disintegrated during an exposure of less than six years. Porous or permeable tile, due to the use of lime mixtures or relatively dry consistencies, were disintegrated in sulphate waters of relatively low concentrations. Dense tile of the best quality exposed to sulphate waters disintegrated under certain conditions, de-

pending upon the concentration of the salts in the seepage water and the alkali and moisture conditions in the soil immediately surrounding the tile.

It was found that disintegration may be manifested in sulphate waters by physical disruption caused by expansion resulting from the crystallization of salts in the pores, but that it is primarily due to chemical action between the salts in solution and the constituents of the cements. In the case of dense tile of low permeability exposed to sulphate waters, disintegration may occur at or just inside of the surface skin and progress into the wall of the tile. A thin outer skin of apparently unaffected concrete was apparent in the case of disintegration of the best quality of tile. The results indicate that this carbonized coating, while immune to attack by salts in solution, is not waterproof, and alkali may pass through it into the mass. With a concrete or mortar of a given quality the disintegrating effect of sulphate waters seemed to vary with the concentration of the solution.

Tile made by the process commonly used, which allows the removal of forms immediately after molding, were found to be more susceptible to disintegration where exposed to sulphate soils or waters than tile made of a wetter consistency, requiring their retention in the molds for a period of hours. The use of hand-tamped tile of plastic consistency, such that the jacket can be removed immediately after molding, is not recommended in sulphate soils and waters. Tile of plastic consistency, molded in the packerhead type of machine, were more resistant to alkali than the hand-tamped tile, but the best quality of packer-head machine tile were affected by waters of higher salt concentration. Steam-cured tile showed no greater resistance to alkali action than tile cured by systematic sprinkling with water. Tile made of sand cement had less resistance to alkali action than tile made of Portland cement of the same proportions. Neither a tar coating nor a cement grout coating was effective in preventing the absorption of alkali water into the walls of the tile. No advantage was found in introducing ferrous sulphate into the cement mixture, and the use of this material reduced the crushing strength of the tile.

It is concluded that if cement drain tile are to be used in soils and waters containing 0.1 per cent or more of salts of the sulphate type, their installation should be preceded by an examination of subsurface alkali conditions, and that quality of cement drain tile can best be measured by permeability tests. With other conditions equal, tile of the lowest permeability will be the most durable. Little definite relation was found between permeability and the related factors of porosity, absorption, and density.

An appendix dealing with absorption tests of tile and with the presence and distribution of salts in the soil and their action on cement and concrete is included.

A. S. T. M. standards adopted in 1922 (*Philadelphia: Amer. Soc. Testing Materials, 1922, pp. 54, figs. 9*).—This pamphlet contains 12 standards adopted by the American Society for Testing Materials in 1922. It includes sections on nonferrous metals, cement, lime, gypsum, clay products, and miscellaneous materials.

Farm Light and Power yearbook, 1922 (*New York: Farm Light and Power Pub. Co., Inc., 1922, pp. 338, figs. 180*).—This is a directory of manufacturers and wholesalers of farm electric light and power apparatus and a manual of information on the operation and maintenance of electric generators and motors, gas and oil engines, storage batteries, wiring for light and power, accessories, appliances, etc.

Motor vehicle transportation, H. C. SPURR (*Rochester: Pub. Utilities Rpts., Inc., 1922, pp. 696*).—The purpose of this volume is to bring together in con-

venient form the various rules, regulations, policies, and practices affecting motor vehicle transportation in the United States.

Economy of tractor-drawn binders and mechanical stooking (*Impl. and Mach. Rev.*, 48 (1922), No. 569, pp. 640, 641, figs. 3).—Comparative studies of the economics of harvesting oats with a horse-drawn binder, a tractor-drawn binder, a tractor and two binders, and a tractor-drawn combination binder and shocker are reported.

Mechanical binding was found to effect a saving of 75 per cent in hand labor over hand binding. The combined operations of binding and shocking gave results considerably superior to the two binders plus hand shocking. The mechanically made shocks consisted of 6, 8, or 10 sheaves as desired, and were delivered safely and well out of the shocker cradle.

The mechanical shocker is attached to the ordinary binder by two tubular stays, the more important one passing from about the center of the bull wheel and supporting a chain and sprocket wheel which transmit the drive to the shocker. The latter runs alongside but a little in the rear of the binder, so that its forecarriage, on which rests the sheaf-delivery fork, is exactly where the sheaves are delivered from the binder. As the first sheaf is released by the binder it is held by an arrangement until a second one arrives, and thereafter a kicker device delivers a pair of sheaves simultaneously directly on the fork. The latter takes them over to the cradle where they lay lengthwise, with the straw end pointing rearwards. Other sheaves come along until the requisite number is received, a special tying mechanism passes binder twine around the whole, pulls it tight and ties it, and then the shock is discharged butts downward.

Septic tanks for sewage disposal, E. G. WELCH and J. B. KELLEY (*Ky. Agr. Col. Ext. Circ.* 131 (1922), pp. 3-19, figs. 10).—Practical information on the planning and construction of septic tanks for sewage disposal, with particular reference to conditions in Kentucky, is presented in this report. It has been found that under conditions in Kentucky the tank should hold at least 24 hours' flow of sewage, and that in a 2-chamber tank the siphon chamber should hold from one-third to one-half the flow of sewage in 24 hours.

In the construction of disposal beds the tile should be placed at a depth of about 12 in. For the average Kentucky soil 40 ft. of 4-in. draine tile will be required in the disposal bed for each person using the system. If the soil is quite porous or sandy 30 ft. of tile per person will be sufficient. The distance between parallel lines of tile in the disposal bed should not be less than 10 ft., and the length should be between 60 and 100 ft. The disposal lines should have a fall of from 1.5 to 2.5 in. per 100 ft., the former being for a clay soil and the latter for a soil which absorbs water readily. It has been found that the liquid as it leaves the septic tank has not been purified sufficiently and should not be permitted to seep into the soil near a well or other water supply.

Helpful hints on painting, M. J. FARRELL (*Conn. Agr. Col. Ext. Bul.* 55 (1922), pp. 12).—Practical information on the selection of ingredients for paints and varnishes and on their proportioning, mixing, and application is presented in this bulletin.

RURAL ECONOMICS AND SOCIOLOGY.

Causes of high cost of production of maize and the remedy, E. PARISH (*Union So. Africa Dept. Agr. Jour.*, 4 (1922), No. 5, pp. 417-429, figs. 3).—These are summarized as low yield; high labor cost and high cost of grazing of oxen, costly methods of plowing, and the variable methods of payment of native labor; lack of diversity of crops, resulting in an uneconomical use of labor;

high cost of management; overcapitalization of land or oxen, resulting in excessive overhead charges; farming on capital borrowed at high rates of interest; nonuse of fallows and winter plowing; and failure to make the best use of the products of the farm. Other factors, with regard to which information was obtained in an investigation of the costs of producing corn in the Union of South Africa for the season of 1920-21, are the area of land worked per implement, the average length of life of implements, the investment per 100 acres of corn, and the ingenuity of individual operators.

Investigations with regard to profits from agriculture for the year ended February 28, 1921, E. LAUR ET AL. (*Ann. Agr. Suisse*, 23 (1922), No. 2, pp. 87-141).—This report deals with investigations carried on in continuation of those previously noted (E. S. R., 46, p. 591).

Colonization and rural development in California (*California Sta. Circ.* 247 (1922), pp. 72, figs. 13).—Several addresses are included here which were delivered in a short course in land settlement held at the University of California in September, 1921.

What should be the next step in rural development? E. Mead (pp. 5-30).—It is held that land settlement must become a public enterprise conducted on the basis of a policy of granting long-time loans to settlers at a low interest rate, providing farms for settlers both from California and outside of the State.

A farm business summary of 20 farms on the Durham State Land Settlement Colony for the fiscal year ended October 1, 1921, is given in four tables drawn up by R. V. Wright. The average net income of these settlers was \$1,181, more than enough to meet the amortized payments under the 36.5 year plan, but only \$120 more than the average net income of the farm laborer, \$1,061, despite an average investment of nearly \$15,000 in the farm. Furthermore, the income from these laborers' allotments will be increased manyfold when the fruit trees come into bearing.

Selecting land for settlement, C. F. Shaw (pp. 31-38).—The importance of establishing definite knowledge of the soil of tracts under consideration for State land settlements is emphasized. A soil survey is furthermore deemed fundamental to accurately fixing the prices of component parts of the settlement, which may be and are extremely variable.

Capital required by California settlers, R. L. Adams (pp. 39-66).—Costs of material and labor, implements and machinery, live stock other than work stock, and minor equipment, as well as the proportion of labor to total cost of structures, are tabulated to indicate the probable required initial outlay in taking up a farm. The income possibilities of various important field and fruit and truck crops under California conditions are similarly presented. These tables show a range of acre returns from \$6.55 to \$301 for crops after they have become full bearing. It is estimated that the returns from intercrops, alfalfa, and fruit crops during the period of development will cover all necessary cash outlays, exclusive of labor and interest on money invested, and leave a total surplus.

The capital needs of four types of farm business, the diversified farm, a deciduous fruit farm, a dairy and hog ranch, and a 2,000-fowl poultry plant are discussed and summarized.

Rural planning, J. W. Gregg (pp. 67-72).—Certain general rules to be followed in farm home planning are put forward.

Conacre lettings (*Ireland Dept. Agr. and Tech. Instr. Jour.*, 22 (1922), No. 1, pp. 38-41).—Some information is given here regarding the practice, known as conacre letting, of renting land for certain specified crops and for a definite period. Variations in different Irish counties in the term and arrangements for payment are pointed out.

Memoranda for the use of the Joint Congressional Committee on short-time rural credits, December 20, 1921 (*Washington: Govt., 1921, pp. 172*).—These consist of extracts from Rural Credits, Land and Cooperative, by M. T. Herrick; Notes on Agricultural Credit Systems Abroad, by LeR. Hodges; Farm Credit and Its Improvement, by V. N. Valgren; Agricultural Credit and Cooperation in Germany, by J. R. Cahill; extracts from reports on agricultural cooperation and rural credit in Europe; Short-time Farm Credit, by A. H. Benton; the text of acts dealing with agricultural credit in the United States and in Canada; and reports on their operation. A digest is given of the main features of the grain-marketing plan of the American Farm Bureau Federation committee of seventeen, and a short bibliography is included.

Local and imperial taxation as affecting agriculture, R. H. Rew (*Jour. Farmers' Club [London], 1922, pt. 4, pp. 73-92*).—A greater increase in the local rate in rural districts than in that for urban centers in Great Britain between 1914 and 1921 is noted and attributed to the fact that in rural areas the salaries and wages of elementary school teachers, policemen, and road men, which were greatly increased during the period, form a larger proportion of the total expenditure than in urban areas.

The proposals for revisions of rates put forward by several organizations representing agricultural opinion are set forth. The grievance of all ratepayers is that local expenditure is unfairly charged on one kind of property, all other kinds being exempt; whereas for national expenditure taxation is avowedly adjusted on the principle of charging in proportion to income. The foremost grievance of ratepayers generally is that they are charged with the cost of services which are advantageous to the whole nation and not merely to the ratepayers of particular localities. It is held that the impression that relief of the rates from national taxation in respect of national services is exclusively an agricultural demand must be corrected.

It is on the owners of agricultural land that the pressure of national taxation falls most heavily and unfairly. The principal complaint of landowners is that the effect of the death duties is often not merely to reduce estates but frequently to dissipate them, and that estate duty, in particular, works greater hardship on agricultural estates than on other forms of property, while in the case of income tax the so-called net income on which the tax is collected is in excess of the true net income received. The amount of local taxation imposed upon agricultural land is held to be of mutual interest to owners and occupiers alike.

Storage of some root crops and other perishable farm products, D. S. BAYBAY (*Philippine Agr., 10 (1922), No. 9, pp. 423-440*).—This describes experiments with root crops, fruits, and vegetables stored under given conditions in a seed laboratory, dark room, ordinary room, cellar, and trench at the Philippine College of Agriculture for about three months. Records were kept of the amount of decay and shrinkage, comparing the average percentage of loss of all the materials used in each storage room.

The cellar was found to be the most efficient, the dark room ranking second. The highest percentage of germinating tubers, excepting ubi, was found in the trench. It is recommended that the utmost care should be exercised in harvesting the products to avoid bruises and other injuries, also that roots for storage should be harvested only during good weather. They should not be washed. An underground cellar with proper ventilation is recommended for storing roots, oranges and lemons, and some vegetables, such as the squash. Tubers should be air-dried before being stored. The trench is recommended for roots, especially those intended for seed purposes.

Weather, Crops, and Markets (*U. S. Dept. Agr., Weather, Crops, and Markets*, 2 (1922), Nos. 15, pp. 297-320, figs. 4; 16, pp. 321-352, figs. 4; 17, pp. 353-368, figs. 2; 18, pp. 369-392, figs. 2).—Temperature and precipitation charts for the weeks ended October 3, 10, 17, and 24, respectively, with weekly summaries of weather conditions, are presented here, together with the usual tabulated weekly reports and special articles on receipts and prices of important classes of crops and live stock and the position in the markets of particular commodities. Monthly summaries on crop condition are given with forecasts of production. The October crop report is contained in No. 16, giving the usual estimated farm value of important products and averages of prices of live stock and crops received by producers September 15 and October 1, 1922, with comparisons.

No. 18 contains a special article showing that the total volume of butter entering into international trade in 1920 was only about one-half as great as the annual average during the five years preceding the war, and a review is given of outstanding changes brought about by the war and of changes in the seasonal trend of supply. Statistics of international trade are given through a period of years.

Rules and regulations of the Secretary of Agriculture under the Food Products Inspection Law of May 11, 1922 (*U. S. Dept. Agr., Off. Sec. Circ.* 160 (1922), pp. 11+6).—These rules and regulations supersede those previously noted (*E. S. R.*, 46, p. 291).

Legal phases of cooperative associations, L. S. HULBERT (*U. S. Dept. Agr. Bul.* 1106 (1922), pp. 74).—Legal questions with respect to the organization, conduct, and operation of cooperative associations are considered from the standpoint of incorporated associations with capital stock, incorporated associations without capital stock, and unincorporated associations.

Producers' cooperative milk-distributing plants, O. B. JESSNESS, W. H. BARBER, A. V. SWARTHOUT, and C. E. CLEMENT (*U. S. Dept. Agr. Bul.* 1095 (1922), pp. 44).—The essentials for success in cooperative milk-distributing plants are set forth here as a volume of business sufficient to make economical operation possible, efficient management, conviction on the part of members that cooperation will benefit them, adequate capital, maintenance of a high standard of quality in the product, and sound business policy. Specific contracts between the organization and producers are deemed advisable as giving stability and permanence to the organization. Methods of financing; forming the association; incorporating; the building and equipment; qualifications, duties, and responsibilities of the managers; problems of operating, including the securing of an adequate and proper milk supply, efficient and economical plant operation, and sales policies and methods of market distribution; and the records necessary are discussed in considerable detail. The appendix gives suggested by-laws for a cooperative milk-distributing association, adapted from a bulletin previously noted (*E. S. R.*, 38, p. 895).

Rural sociology, J. M. GILLETTE (*New York: Macmillan Co.*, 1922, pp. XII+571, figs. 19).—The purpose and scope of rural sociology are defined as the discovery of means of attainment of a sympathetic understanding of the life of the farming communities and the application to them of rational principles of social endeavor. It is an applied science, while general sociology is a theoretical one, and its field is represented as the formulating of programs of betterment. The development and distinctive characteristics of rural society are described, and several types of rural communities are defined. About one-third of the volume is given to a discussion of economic conditions and problems. Under the caption of rural institutions are discussed farm women and the home, the rural school and rural education, and the rural church.

Some special requisites of rural progress, including the development of resident rural leadership, mitigation of rural isolation, and community building, are set forth. A list of questions and a suggested bibliography are included at the end of each chapter.

The rural church, M. DAWSON (*Conn. Agr. Col. Ext. Bul. 54* (1922), pp. 12).—The importance to the church of an understanding of the agricultural problems of the rural community that it serves and of cooperation with the program of the Government for improving rural life is urged, from the point of view of the close connection between economic progress for the community and support for, and opportunity for larger service on the part of, the rural church.

The rural literary and debating society, G. H. UNWIN (*Ontario Dept. Agr. Bul. 290* [1222], pp. 18).—The first part of this bulletin deals with the organization and management of the society, while the second part contains some suggestions for the use of speakers, with others for judges and critics. A few concrete illustrations are given, including a program, a mock parliament, and a mock trial.

The labor movement and the farmer, H. ROBBINS (*New York: Harcourt, Brace & Co., 1922, pp. VII+195*).—This is one of a series known as The Farmer's Bookshelf, edited by K. L. Butterfield. Statements regarding the various branches of the labor movement in the United States and in Europe, its leaders, and the latest programs of trade unionism, socialism, the I. W. W., and communism, as well as international labor relations, comprise about one-half of the volume. Methods of agitation, the rights and interests of the public as affected by them, and remedies for labor's problems, such as trade agreements, collective bargaining, the incorporation of unions, profit sharing, social insurance, labor legislation, mediation and arbitration, and industrial courts, are discussed in the later pages.

AGRICULTURAL EDUCATION.

List of workers in subjects pertaining to agriculture (*U. S. Dept. Agr., List of Workers in U. S. Agr., 1920-21, pp. 82+98; 1921-22, pts. 1, pp. 87; 2, pp. V+103*).—The usual lists of workers are given, part 1 setting forth those employed in the U. S. Department of Agriculture and part 2 those at the State agricultural colleges and experiment stations.

A plan for the organization of a county system of agricultural instruction in elementary rural schools, E. E. WINDES (*U. S. Bur. Ed., Rural School Leaflet 6* (1922), pp. 8).—A plan is presented whereby county superintendents by using the workers already at hand may secure supervision of untrained teachers, correlation of effort, and division of labor among the various agencies at work in the county and organization of subject matter for study and teaching. Supervisors would be selected from among the Smith-Hughes teachers, county and home demonstration agents, extension teachers, and teachers in the county schools who have had superior training and are in sympathy with rural life problems, and these would then proceed by visitation in the schoolroom giving demonstration lessons in the teaching of agriculture, calling the teachers together in groups for definite instruction in agricultural subject matter and methods of teaching, and arranging that groups of untrained teachers may visit a school where good methods of teaching are being used. Certain of these supervisory workers should be selected to be directly responsible for (1) the supervision of teaching in the county schools, (2) the preparation of problem-project outlines for the use of teachers and students covering the essential farm enterprises of the county, (3) the organization of individual problem-project

outlines into a complete course of study, (4) the working out of plans whereby agricultural organizations at work in the county may be interested and assigned a proper share in the educational development of the county, (5) the organization of publicity, (6) the preparation of study outlines as guides to teachers in service, and (7) the collection of illustrative and reference material for the teaching and study of agriculture and making this material available.

The Pennsylvania State plan of organization for teaching agriculture and the Missouri State program for prevocational agricultural education are quoted in detail. A constitution and by-laws for groups of junior project workers are suggested.

The winter short course for high schools, J. E. HILL (*Vocat. Ed. Mag.*, 1 (1922), No. 3, pp. 185-189).—During the year ended July 1, 1921, 115 high schools in Illinois conducted classes in vocational agriculture. Twelve winter short courses, with an enrollment of 138 different students, were conducted according to the local community unit plan. Under the first of two methods of organization used, the short course students came to the high school every school day for all day or one-half day work, both in vocational agriculture and other subjects, during the dull season of the year; and under the other, the farmers were organized into a day class for instruction in agriculture only, for a short period during the winter months. The differences between the organization of a short course for the group of farm boys between the ages of 15 and 21 and that of a short course designed for farmers are pointed out.

It is held that the full day short course conducted daily during the dull season months furnishes the most efficient use of the time available to farm boys. The greatest advantage of the full day or one-half day winter short course is the opportunity to offer instruction in other subjects than technical agriculture, such as English, farm arithmetic, community civics, etc., which will help fit the boy to live as well as prepare him for the vocation of farming.

It is considered that instruction should be in one definite phase of farming, such as animal husbandry, crops, or soils, success depending upon the local interests and the ability of the members of the class to use the information obtained.

Accounts are given of two types of courses, one offered at Geneseo and one at Harvard, Ill., during the winter of 1920-21.

Experiences of Ohio in the conduct of part-time work in agriculture, R. FIFE (*Vocat. Ed. Mag.*, 1 (1922), No. 3, pp. 178-182).—Part-time technical courses (offered in 1921-22) for farm men in various age groups are noted. Tractor courses were found to be most popular. Eleven special instructors were furnished for 28 out of the 30 tractor courses given. These were given a week of intensive training by members of the department of agricultural education and by the specialist in farm power in the department of agricultural engineering at the college.

The aim of the courses was to give a short period of practical instruction in operations which the average farmer can be expected to perform under the conditions and with the tools which he may be expected to possess. Groups of five students were assigned to laboratory work of disassembling and inspecting used gas engines, previously provided. In several communities the Saturday following the close of the course was given over to a farm-power program of a popular nature.

Some of the conclusions drawn from the experience with these courses are that initial part-time courses with groups should permit of the major part of the instruction through laboratory or field work, that farmers and farmers' sons are usually willing to attend school if courses are offered which meet their specific problems, that satisfactory results can not be secured with mixed

age groups, that the use of visual or illustrative material is even more important than in the instruction of full-time students, that the indiscriminate lecture has no place in instruction of this type, and that newspaper and other publicity is a valuable adjunct in interesting prospective students.

A comparatively low enrollment of young men, 16 to 25 years of age, is noted.

A short course in farm shop work, W. F. BRUCE (*Vocat. Ed. Mag.*, 1 (1922), No. 3, pp. 182-185).—A short course conducted by the department of vocational agriculture of a high school in Franklin County, Ohio, during January, 1922, is described.

Agricultural education and research [in Scotland] (*Scot. Bd. Agr. Rpt.* 10 (1921), pp. 26-41).—This section of the tenth annual report of the Board of Agriculture for Scotland records the year's attendance at the agricultural colleges of Scotland, the amount of extension work undertaken and its results, the training offered for ex-service men in agricultural and allied occupations, and the work of continuation classes in agriculture. Research work carried on at each institution in 1921 is briefly outlined.

[**Agricultural education in Algeria**], T. SIEFF ([*Clout. Gen. Algérie*] *Exposé Situation Gén. Algérie*, 1921, pp. 447-489).—These pages continue annual reports on the agricultural institutions and agricultural services previously noted (*E. S. R.*, 47, p. 495).

Home economics education section (*Jour. Home Econ.*, 14 (1922), No. 11, pp. 556-559).—The papers read before this section at the fifteenth annual meeting of the American Home Economics Association held at Corvallis, Oreg., August 1-5, 1922, are Home Economics in Adult Classes, by A. E. Richardson; Teaching Classes of Half a Million, by E. MacDonald; and Adjustments Desirable in Teacher Training Institutions, by L. Stanley.

Home economics extension section (*Jour. Home Econ.*, 14 (1922), No. 11, pp. 552-556).—The proceedings of this section at the meeting noted above include the following papers: A Report on Rural Life Survey, by B. M. Rowe; Are Home Demonstration Programs of Work Educationally Sound, Economically Important, Sociologically Constructive? by C. W. Pugsley; Cooperation Between Home Demonstration and Research Specialists, by M. C. Denton; and Additional Special Training for Home Demonstration Workers, by R. G. Smith. The recommendations of the committee on requirements in the training of home demonstration workers are also given.

The county agent and the farm bureau, M. C. BURRITT (*New York: Harcourt, Brace & Co.*, 1922, pp. XVI+269, pls. 8).—This is another of The Farmer's Bookshelf series (see p. 190).

County programs of work and county, State, and National farm bureau organization and relationships are described in the 140 pages of part 1 from the point of view of the county agent's services. The historical background and present organization and status of county agent work, the farm bureau, and State and National federations are presented in part 2.

The attitude is taken with regard to tendencies toward commercialism that the farm bureau might be better used as an educational means to encourage and foster specific local unit and commodity agencies adapted to marketing activities. It is further maintained that local associations of farmers and the colleges must provide funds and together administer them, this requiring the joint employment of the county agent, the sharing of his salary, and the joint supervision of his work.

Practical plant biology.—A course of elementary lectures on the general morphology and physiology of plants, H. H. DIXON (*London and New York: Longmans, Green & Co.*, 1922, pp. XI+291, figs. 94).—A limited number of the simpler as well as the more complex plants are selected for study.

Business geography, E. HUNTINGTON and F. E. WILLIAMS (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1922, pp. X+482, figs. 97*).—The material herein is presented in five parts, the first setting forth geographical principles in business, and the others devoted, respectively, to business relations as evolved among typical communities, the business of the continents, the business of the United States and Canada, and statistical tables.

Food preparation: A laboratory guide and notebook for high school classes in domestic science, B. W. JOSSEMAN (*Peoria, Ill.: Manual Arts Press, 1922, rev. ed., pp. 282, figs. 5*).—This is a revision of a combined laboratory guide and student's notebook previously noted (*E. S. R.*, 40, p. 96).

MISCELLANEOUS.

Forty-fifth Annual Report of Connecticut State Station, 1921, E. H. JENKINS ET AL. (*Connecticut State Sta. Rpt. 1921, pp. XI+445, pls. 31, figs. 11*).—This report contains the organization list, a report of the board of control, a financial statement for the fiscal year ended June 30, 1921, and reprints of Bulletins 232-239, previously noted.

Second Annual Report of Georgia Coastal Plain Experiment Station, 1921, S. H. STARR (*Georgia Coastal Plain Sta. Bul. 2 (1922), pp. 29, figs. 13*).—This contains the organization list and a report of the director on the work of the station during the year. The experimental work reported is for the most part abstracted elsewhere in this issue. A variety test with beans is also noted.

Thirty-third Annual Report of Kentucky Station, 1920, II (*Kentucky Sta. Rpt. 1920, pt. 2, pp. [V+335], pls. 12, figs. 33*).—This contains reprints of Bulletins 225-230 and of Circular 24, all of which have been previously noted.

Thirty-fourth Annual Report of Kentucky Station, 1921, T. COOPER (*Kentucky Sta. Rpt. 1921, pls. 1, pp. 53; 2, pp. [539]+IV, figs. 49*).—Part 1 of this report contains the organization list, a financial statement as to the Federal funds for the fiscal year ended June 30, 1921, a report of the director on the work and publications of the year, and meteorological data. The experimental work reported is for the most part abstracted elsewhere in this issue.

Part 2 contains reprints of Bulletins 231-238 and of Circulars 25-27, all of which have been previously noted.

Monthly Bulletin of the Ohio Experiment Station (Ohio Sta. Mo. Bul., 7 (1922), No. 9-10, pp. 137-168, figs. 8).—This number contains, in addition to several articles abstracted elsewhere in this issue, the following: Parasites of Sheep, by D. S. Bell; and Some Poultry Diseases, by D. C. Kennard.

NOTES.

Arizona Station.—The appointments are noted of Robert H. Burns and C. A. Smith as assistant animal husbandmen.

Arkansas University and Station.—Dr. John A. Elliott, since 1917 professor of plant pathology in the college of agriculture and plant pathologist in the station, died at Washington, D. C., January 19, while temporarily employed by the U. S. Department of Agriculture. Dr. Elliott was born at Ness City, Kan., December 1, 1887. He was graduated from Fairmount College in 1913, receiving the A. M. degree from the University of Kansas in 1914 and that of Ph. D. from the University of Illinois in 1916. He served as associate plant pathologist of the Delaware Station in 1916-17.

Missouri University and Station.—Dr. C. R. Moulton, chairman of the department of agricultural chemistry, resigned January 1 to become head of the bureau of nutrition of the Institute of American Meat Packers.

New Jersey College.—Director L. A. Clinton, in charge of extension work since 1918 and widely known as a station and extension worker, died in his fifty-fourth year at Detroit, Mich., January 21, after three months' sickness.

Professor Clinton was a native of Michigan and after a boyhood on a farm was graduated from the Michigan College in 1889. Later he took up graduate work at Cornell University and received the M. S. degree from the Michigan College in 1902. From 1890 to 1893 he was assistant to the director of the Michigan Station, from 1893 to 1895 assistant agriculturist at Clemson College, and during the next seven years assistant agriculturist of Cornell University. In 1902 he became professor of agriculture in the Connecticut College and director of the Storrs Station, holding these positions until 1912, when he was appointed agronomist and assistant chief of the Office of Extension, North and West, in the U. S. Department of Agriculture. This position he held until 1918, when he was made director of extension in New Jersey. In 1912 he served as president of the American Society of Agronomy.

New York State Station.—Dr. J. S. Joffe, research assistant in microbiology of the New Jersey Stations, has been granted a four months' leave of absence for a special study at this station of soil bacteriological problems.

Alwin Berger, formerly superintendent of the Royal Parks and Gardens for the State of Wurttemberg, Germany, has been appointed assistant in research in horticulture vice F. R. Clark, resigned. He will devote his time largely to a botanical study of the new fruit varieties developed by the station, and is collecting botanical material and museum specimens in Germany and England for use in this work. He is expected to reach this station about April 1.

Dr. R. S. Breed is making a special study in Europe of dairy conditions, returning about August 1.

Pennsylvania College and Station.—By will of the late Dr. William Frear, the college has received a gift of his collection of scientific works and publications. The department of horticulture has been given \$200 and the use of a farm for experimental purposes by a fruit grower of the State.

South Dakota College.—President W. E. Johnson has resigned to take effect June 30.

American Society of Agronomy.—The fifteenth annual meeting of this society was held at Washington, D. C., November 20 and 21, 1922.

The president's address was given by L. E. Call of the Kansas College and Station on Increasing the Efficiency of Agronomic Research. Professor Call reviewed the difficulties of the early agronomist with his manifold duties, and pointed out the improvement obtained in this field by specialization. The World War and the reconstruction period were elements impeding progress in the science. The necessity was emphasized for thorough basic training, clear understanding of research problems, a love for work, a spirit of consecration, and cooperation. In bringing out the value of cooperation between agronomists and other scientists, and with the investigators of adjacent States, bureaus of the U. S. Department of Agriculture, national scientific institutions, and agricultural industries, Professor Call stated that neglecting or ignoring the experience of other workers developed a selfishness exemplified by the "single-track mind."

In accordance with the prevailing custom of the society, the program consisted mainly of three symposia, allowing opportunity for the thorough discussion of the topics presented. A notable achievement was the presentation in person of all but one of the 20 papers scheduled on the program.

The first symposium dealt with phosphorus and was led by F. E. Bear of Ohio State University, chairman of the phosphorus committee. Papers were presented on The Effects of Phosphate on Early Growth and Maturity, by C. F. Noll of the Pennsylvania College and Station; The Foraging Power of Plants for Phosphate Rock, by F. C. Bauer of the University of Illinois; Methods of Distribution of Phosphate Fertilizers, by S. B. Haskell of the Massachusetts Station; The Necessity of Sulphur Carriers in Artificial Fertilizers, by W. Crocker of the Thompson Institute of Plant Research; Organic Phosphorus in Soils, by O. Schreiner, Bureau of Plant Industry, U. S. Department of Agriculture; Chemical Analysis to Determine Phosphate Needs, by E. Truog of the Wisconsin University and Station; and The Economic Use of Phosphate Deposits, by W. H. Waggaman, Bureau of Soils, U. S. Department of Agriculture.

The improvement of agronomy teaching formed the subject of the second symposium. It was led by W. C. Etheridge of the Missouri University and Station, who also gave a Report on the Progress in Standardizing the Elementary Course in Field Crops. A Report on the Progress in Standardizing the Elementary College Course in Soils was given by P. E. Karraker of the Kentucky University and Station. Other papers were presented on The Organization of an Introductory Course in Soils and the Extent to Which It Should be Placed on the Basis of Pure Science, by H. O. Buckman of Cornell University; The Relation of the Elementary College Courses in Field Crops and Soils to Those Offered in Smith-Hughes Schools, by W. L. Burlison of the Illinois University and Station, with a discussion led by M. F. Miller of the Missouri University and Station; Comparative Grades in Field Crops Courses, by T. K. Wolfe of the Virginia College and Station; and Laboratory Instruction in Field Crops, by J. H. Parker of the Kansas College and Station.

The third symposium took up the application of statistical methods to the results of field tests. This was opened by a paper by the leader of the symposium, Dr. H. H. Love of Cornell University and Station, on The Importance of the Probable Error Concept in the Interpretation of Experimental Results. Papers were also presented by J. A. Harris of the Station for Experimental Evolution, Carnegie Institution, on The Service of Statistical Formulae in the Analysis of Plot Yields; H. K. Hayes of the Minnesota University and Station on Controlling Experimental Error in Nursery Trials; C. H. Myers and F. R. Perry of the Cornell University and Station on Analysis and Interpretation of Data Obtained in Comparative Tests of Potatoes; R. Summerby of Macdonald College on Replication in Relation to Accuracy in Plot Tests; and T. A. Kiessel-

bach of the Nebraska University and Station on Competition as a Source of Error in Corn Yield Determinations.

Reports were also received from the advisory committee on agronomy to the National Research Council, and from the committees on specialization of field experiments, terminology, varietal standardization, uniform classifications and terminology, intercollegiate grain judging contests, and on national organization of agronomy students. Officers were elected as follows: President, S. B. Haskell; vice presidents, M. F. Miller and E. Truog; representative to the American Association for Advancement of Science, W. L. Slate; and member of the advisory committee on agronomy to the National Research Council, C. W. Warburton.

American Society of Agricultural Engineers.—This society held its sixteenth annual meeting at St. Louis on December 27, 28, and 29, 1922.

An address of welcome was given by Hon. H. W. Keil, mayor of St. Louis, and the president's address by A. J. R. Curtis. Among other points touched upon in the latter, special emphasis was placed upon the importance of research, and comment was made upon the progress and achievements in that line during the year. The main program as usual was divided into four sub-programs corresponding to the reclamation, college, farm structures, and farm power and equipment sections of the society.

The reclamation program was opened by A. L. Fellows of the U. S. Department of Agriculture, with an address on the status, progress, and problems of irrigation. E. R. Jones of the University of Wisconsin presented a paper on Where to Drain, in which the nature and extent of drainage in the peat and muck soils of Wisconsin were discussed. In this connection the importance was brought out of combining drainage with other fertility and cultural practices.

M. E. Jahr of the University of Wisconsin, as a member of the land clearing committee, gave a brief review of the status and progress of land clearing operations in Wisconsin, with particular reference to the development of a marsh plow, equipped with special lowering and raising devices, a special knife coulter attached to the beam, and a special point. Tests have indicated that this plow effects an average saving of 38 per cent in time required in the removal of clogs.

H. B. Walker of the Kansas College presented the report of the colonization committee and a paper on The Economic Effect of Further Reclamation and Colonization of Agricultural Lands. In the latter it was stated that the colonization of reclaimed public lands will depend largely upon the prevalent economic situation of farming.

D. Weeks of the University of California gave an illustrated paper on the demand for the agricultural engineer in the operation and development of reclamation projects, in which opportunities for service encountered in a study of the water resources of California were described.

A paper on Standard Drainage Specifications was presented by E. V. Willard, commissioner of drainage and waters of Minnesota. Other reclamation committee reports presented were those on Soil Erosion and Drainage, by Q. C. Ayres of the Iowa College, and E. R. Jones of the Wisconsin University and Station, respectively, both of which subjects apparently are developing some interesting research features.

The college section program was opened by a paper on Vocational Education in Agriculture, by C. H. Lane of the Federal Board for Vocational Education. In this paper it was emphasized that teachers in secondary schools teaching vocational subjects should be equipped with both technical and teaching knowledge.

J. C. Martin presented a paper outlining the problem of the use of electrical energy from central stations on the farm. Special emphasis was placed upon the importance of looking into the research features of adapting the use of electrical energy from central stations to the requirements governing farm power utilization, and different possible uses of electrical energy on farms were reviewed. The opinion was expressed that there is a place for both the isolated plant and central station service on the farm.

A paper on the Psychological Tests at Ohio State University, by F. W. Ives, briefly described the tests given freshman students to determine their fitness for pursuing courses of study in agricultural engineering, and those given higher students to determine the degree of their advancement.

The Standardization of Farm Motor Courses was discussed by W. J. Gilmore of the Oregon College, on the basis of a survey of 17 institutions in the United States and Canada offering such courses. The opinion was expressed that there is ample opportunity for the standardization of such courses to make them more effective. The lack of a suitable standard text and laboratory manual and of standard laboratory equipment seems to be one of the outstanding difficulties of present practice.

E. J. Stirniman of the University of California presented a paper on Extension Work in Agricultural Engineering, in which the more important features and problems of the subject were discussed. Other college section committees reporting were those on extension, research, and teacher's directory.

The farm power and equipment section program was opened by a report of studies of air cleaners for tractor engines, presented by A. H. Hoffman of the California Station. This report was based upon studies conducted for the past three years at the station on the fundamental principles governing the maximum removal of dust and other foreign matter from the intake air of tractor motors. Thirty different methods were studied, including water, oil, and dry types, and cleaning efficiencies ranging from 42.7 to 99.8 per cent were obtained in the laboratory and from 37.6 to 99.9 per cent in the field. The conclusion was drawn that it is possible to remove practically all of the dust from the air entering an engine by the use of the absolute cleaner, the principles of which were derived from the studies.

A paper on The Influence of Wheel Equipment on Tractor Efficiency was given by E. S. Patch, which was based upon studies of the effect of soil, weight on drive wheels, speed, drawbar load, and condition of soil surface upon impulsive traction. The soil factors found to be of importance are specific gravity, moisture content, hardness, and resistance to shear. No suitable methods of adequately expressing the two latter factors have as yet been devised, so that their actual influence, while obviously considerable, is as yet unknown. It was further found that increasing the weight on the drive wheels increases the drawbar load capacity. Slippage of drive wheels was found to vary inversely with the square of the wheel diameter and to govern the ultimate efficiency. The best results were obtained with a 45-in. wheel equipped with less than 14 cleats. Wheel slippage was also found to be approximately proportional to drawbar load up to 60 per cent of the weight of the tractor. Increasing the height of hitch from 13 to 17 in. also increased tractive efficiency.

G. B. Gunlogson presented an illustrated paper on Field Experience As a Scientific Factor in the Design and Improvement of Farm Machines. The object stated was to point out how to reduce depreciation of farm machinery by proper and improved design and development, based upon field performance as well as engineering knowledge. In connection with depreciation a so-called replacement factor has been derived in the course of field studies, which is

expressed as the ratio of the number of spare parts used to the number of machines.

A paper on haying machinery, especially where tractor power is used, was presented by W. Thomas. Statistical data were presented in support of the contention that the increasing use of the tractor will have little influence on the demand for hay, since the replacement of horses would not affect over one-fifth of the total annual crop, and this might be offset by increased feeding of hay to other farm animals. Different haying operations using tractor power were described, and some of the problems involved in the development of motor-drawn haying machinery were discussed. The conclusion was drawn that hay-making can be done successfully and economically with tractors, especially with the newer types of haying machinery.

O. W. Sjogren of the Nebraska University and Station tendered the report of the tractor testing and rating committee, in which a standard testing and rating code was introduced, yet to be approved by the standards committee. This code provides that the belt horsepower rating shall not exceed 80 per cent of the maximum load which the engine will maintain by belt at the brake or dynamometer for two hours at rated speed, and that the drawbar rating shall not exceed 80 per cent of the maximum drawbar horsepower developed in the same gear as the rated drawbar load in the official tests conducted at the university under the State tractor testing law.

Prof. Sjogren also presented a paper on tractor testing and rating based upon the tractor testing work at the university. I. W. Dickerson discussed farm lighting, and G. W. McCuen of the Ohio State University reported the status of the left-hand plow investigation, which has been in progress at the Ohio and other institutions for some time. R. H. Black of the U. S. Department of Agriculture reported the progress of studies by the Department on the development of grain handling equipment, which have included especially devices for the removal of foreign material from wheat. E. V. Collins of the Iowa Station reported the status of the disk harrow investigation at that station. Apparently the disadvantages of a cutaway disk harrow considerably outweigh its advantages.

The report of the committee on motor fuels was presented by A. H. Gilbert, and on animal motive power by W. Dinsmore. The latter report described an apparatus devised at the Iowa Station to test the energy output of mules and horses.

The farm structures section program was opened by a paper on Building the Modern Rural Home, by K. J. T. Ekblaw. Emphasis was placed upon the importance of building for permanence as well as convenience. Miss J. Hansen of the Iowa College presented a paper on Making the Farm House a Home, which was based upon the studies in progress in the rural art department of the college.

Some of the lessons to be learned from failures of farm buildings in a tornado were discussed in an illustrated paper by V. Overholt of the Ohio State University. The studies have shown that braced rafter barns have withstood tornadoes better than other types of barn structure. In addition, structures which were not anchored to the foundation often withstood storms better than anchored structures, being shifted rather than demolished.

F. W. Ives of the Ohio State University presented some new ideas in group planning of farm buildings, based upon work at that institution. C. A. Norman of Purdue University briefly described types of poultry houses that have made good in Indiana. W. A. Foster and A. W. Clyde, of the Iowa Station and College, presented an illustrated report of studies on self-supporting barn roofs. A particularly interesting feature of this report was the description

of methods used in testing small-scale structures. Mathematical analyses of the stresses in the different structures tested were made where such was possible. It was pointed out that some barn roof structures are statically indeterminate, while others, such as the Shawver frame, can not be treated as trusses.

E. W. Lehmann of the Illinois University and Station summarized existing station projects on the subject of septic tanks. Apparently very little comprehensive work on the subject is in progress.

M. A. R. Kelley of the U. S. Department of Agriculture presented the reports of the committee on farm building equipment and ventilation. The latter report, based on three years of study by the Department, was accompanied by a map and climatological data showing building zones and relative humidity figures for the entire United States. These data were considered to indicate the absurdity of making blanket recommendations to cover all sections of the country in the design of farm building ventilation systems. The map was a graphic summary of data obtained from U. S. Weather Bureau reports from 100 selected stations covering a period of 30 years. The recommendations made were based primarily upon studies of tobacco barns in Tennessee and Kentucky and of general farm and dairy building construction in the New England States.

In general session, the report of the society general committee on standardization was presented by E. A. White, in which progress in the standardization of different types of farm equipment was especially indicated.

R. W. Trullinger of the U. S. Department of Agriculture presented the report of the general committee on research in agricultural engineering. This included a critical review of the more important investigation, experimentation, and research in the subject being planned or in progress at the State colleges and experiment stations, at certain other State and Federal institutions, and at certain foreign agricultural and engineering institutions, during the year 1922. In addition, it was brought out that the personal study of agricultural engineering projects made by the committee during the year indicates the paramount importance to every project of a clear and definite aim, and of careful and exhaustive preliminary analysis and planning of the method of approach and procedure.

The meeting was closed by visits to plants manufacturing structural materials primarily of interest to agricultural engineers.

Officers for the ensuing year were elected as follows: President, E. W. Lehmann of the University of Illinois; vice presidents, R. W. Trullinger of the U. S. Department of Agriculture and A. H. Gilbert; secretary and treasurer, Raymond Olney; and member of the executive council, W. Aitkenhead of Purdue University.

Florida Tropical Garden.—The War Department has turned over to the U. S. Department of Agriculture a tract of 850 acres formerly used as an aviation field and located at Biscayne Bay, 12 miles south of Miami, Fla. This tract has a coast line of about 1.4 miles, and contains about 195 acres of pine land and rock reef and 655 acres of lowland and mangroves more or less subject to overflow. Because of this location in a region particularly free from cool winter temperatures, it is thought that the tract can be advantageously developed as a tropical garden where such plants as the mango, coconut palm, and West Indian avocado can be grown with safety. A test orchard and arboretum will be built up, although for the present the smaller gardens conducted by the Department at Miami since 1898 and Buena Vista since 1914 will be continued. The management of the new garden will be under the Office of Foreign Seed and Plant Nutrition of the Bureau of Plant Industry.

Agricultural and Veterinary College of Minas Geraes, Brazil.—A communication recently received from Dr. P. H. Rolfs, who is in charge of this institution, states that a location has been selected at Viçosa, about 125 miles north of Rio de Janeiro, in what is known as the "zona de matta." This is the most densely populated farming district of the State and contains about 2,500,000 people.

The location chosen has an elevation of over 2,000 feet with an equable climate. The average annual temperature is about the same as that of Miami, Fla. The winters are somewhat warmer and the summers cooler. The average rainfall is about 78.7 inches, nearly all of it falling in the summer months of November, December, January, and February.

The plans adopted by the State government provide for a main building, a dormitory, and some 25 farm buildings and residences. The plan for the main building, erection of which is under way, provides for an assembly room with a seating capacity of 400, a library, an agricultural exhibits room, and classrooms, laboratories, and professors' studies for 12 departments. The building will be about 288 by 98 ft. and two stories high, while the dormitory will be about 275 ft. long and two stories high.

The site selected contains about 840 acres of land typical of the "matta" region. Two coffee plantations and one sugar cane field were on the farms at the time of purchase. The tract is located on the edge of Viçosa, a city of more than 5,000 inhabitants. The Leopoldina Railway passes through the property and has provided a siding to deliver building material, which later will be used as a station for the college. The work of preparing the experimental plats has been commenced, and instruction will probably be inaugurated during the ensuing year.

Tribunal for Investigation of the Agricultural Problem in Great Britain.—A tribunal of three economists has been appointed in Great Britain to "inquire into the methods which have been adopted in other countries during the last 50 years to increase the prosperity of agriculture and to secure the fullest possible use of the land for the production of food and the employment of labor at a living wage, and to advise as to the methods by which those results could be achieved in this country." The tribunal consists of Sir William Ashley, professor of commerce and vice principal of the University of Birmingham; W. G. S. Adams, Gladstone professor of political theory and institutions, Oxford; and D. H. MacGregor, Drummond professor of political economy, Oxford. C. S. Orwin, director of the Institute for Research in Agricultural Economics at Oxford, has been appointed agricultural assessor to the tribunal, and D. B. Toye of the Ministry of Agriculture and Fisheries will act as secretary.

ADDITIONAL COPIES
OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.

AT
10 CENTS PER COPY
SUBSCRIPTION PRICE, 75 CENTS PER VOLUME

PURCHASER AGREES NOT TO RESELL OR DISTRIBUTE THIS
COPY FOR PROFIT.—PUB. RES. 57, APPROVED MAY 11, 1923

EXPERIMENT STATION RECORD.

VOL. 48.

ABSTRACT NUMBER.

No. 3.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

The water-soluble constituents of the alfalfa plant, T. B. OSBORNE, A. J. WAKEMAN, and C. S. LEAVENWORTH (*Jour. Biol. Chem.*, 53 (1922), No. 2, pp. 411-429).--The chlorophyll-free juice extracted from the alfalfa plant by the methods described in a previous paper (*E. S. R.*, 46, p. 801) has been made the subject of a further study.

In addition to the colloid precipitate obtained by adding 20 per cent by weight of alcohol to the freshly expressed chlorophyll-free juice, a second precipitate, Precipitate II, has been obtained by raising the alcohol content of the filtrate from the colloid precipitate to 53 per cent by weight by adding an equal volume of 93 per cent alcohol. This precipitate was found to contain about 14 per cent of the solids of the fresh alfalfa juice and 8 per cent of the original nitrogen, most of which is thought to be protein and to consist of a small residue of colloid not completely precipitated by the 20.5 per cent alcohol. Analyses of the ash of the colloid precipitate, Precipitate II, and filtrate, together with the calculated proportion of each precipitated by 53 per cent alcohol are reported. These data show that more than one-half of the inorganic constituents are removed by adding 53 per cent of alcohol, only a small part of the calcium, phosphoric acid, and sulphuric acid remaining in the solution. Evidence is presented that the magnesium, calcium, phosphorus, and sulphur are all in inorganic combination.

Preliminary studies of the various types of nitrogen in the filtrate, representing 49.5 per cent of the nitrogen of the juice and 16.1 per cent of that of the plant, gave the following results in terms of percentage of the total nitrogen in the filtrate: Before hydrolysis, ammonia nitrogen, 5.7, basic nitrogen 44.4, nitrogen in the MgO precipitate 1.3, and free amino nitrogen 20.2 per cent. Corresponding results on the filtrate after hydrolysis with hydrochloric acid are, respectively, 17, 20.4, 11.2, and 41.7 per cent. Tests of the basic substances before and after hydrolysis gave negative results for arginin and lysin and inconclusive for histidin. It is concluded that most of the basic nitrogen belongs to nitrogenous substances quite different from those yielded by protein hydrolysis.

An examination of the coloring matter of the juice has shown that it can be extracted by successive shaking with isoamyl alcohol and similarly by butyl alcohol. This separates the coloring matter from the inorganic constituents of the juice and from a large part of the nonnitrogenous substances, but a relatively large proportion of the nitrogenous substances, particularly the

strongly basic substances, are extracted with the coloring matter. It is thought that the color is due to the presence of substances belonging to the group of flavones, although no chemical evidence has been obtained sufficient to support this view. These flavonelike substances are combined with the protein and other constituents of the plant, from which they are set free by hydrolysis. It is considered of significance that when colorless yeast cells are hydrolyzed by boiling with hydrochloric acid and the hydrolysate shaken with isoamyl alcohol a deep red color is obtained which can not be distinguished from that obtained from the alfalfa. This is thought to indicate that these colored substances are widely distributed constituents of vegetable cells and are of physiological importance, although not specially concerned in photosynthetic processes.

The rate of hydrolysis of wheat gliadin, H. B. VICKERY (*Jour. Biol. Chem.*, 53 (1922), No. 2, pp. 495-511, figs. 4).—A study is reported from the Connecticut State Experiment Station of the rate at which ammonia is set free from gliadin at boiling temperature by hydrochloric acid in concentrations varying from 0.1 to 20 per cent, and also the rate of hydrolysis of the peptid bonds as indicated by the appearance of free amino nitrogen. A few experiments were also conducted in which sulphuric acid, sodium hydroxid, and barium hydroxid were used as the hydrolytic agents.

Ammonia was very readily set free from gliadin by dilute acid or alkali. With 0.027 N (0.1 per cent) HCl the ammonia was set free quite rapidly at first and then more slowly. With 0.1 N HCl nearly all the ammonia was set free in 11 hours and with 0.2 N in 5 hours. At concentrations of acid higher than 1 N the rate of liberation of ammonia was so rapid as to be impossible of measurement by the methods employed. At higher concentration there was an increased production of ammonia due to secondary decomposition. Sulphuric acid at a concentration of 0.2 N was less effective as a hydrolyzing agent than 0.2 N HCl.

With alkaline hydrolyzing reagents the rate of hydrolysis of the amid nitrogen was more rapid than with acid. The reaction is considered to consist of three phases. The first, in which the greater part of the ammonia is liberated rapidly, represents the hydrolysis of the amid nitrogen; the second, in which ammonia comes off more slowly, the decomposition of arginin; and the third, in which the liberation of ammonia is very slow, the decomposition of amino acids other than arginin. It is thought that these reactions proceed simultaneously but become evident on the curve as they are successively terminated. Barium hydroxid proved to be a more rapid hydrolyzing agent than sodium hydroxid of the same concentration with respect to the first phase, but less rapid in the other two phases.

The initial rate at which the peptid bonds of gliadin are split is much more rapid with alkaline reagents than with acids of equivalent concentration. With dilute acids it has been found possible to remove nearly all of the amid nitrogen and at the same time split very few of the peptid bonds, while with alkalis the peptid bonds break very rapidly.

"The curves which show the rate of hydrolysis of gliadin by the stronger acid hydrolyzing reagents have no irregularities, but indicate that if hydrolysis is sufficiently prolonged it will eventually become complete. The peptid bonds of the protein are broken successively in a perfectly smooth manner, the process continuing until the entire molecule is hydrolyzed to amino acids. The action of acid-hydrolyzing agents is thus in sharp contrast to that of enzymes."

Progress in protein research, K. FELIX (*Ztschr. Angew. Chem.*, 35 (1922), No. 46, pp. 273-275).—A brief review of recent developments in protein chemistry.

Researches on cellulose, IV. C. F. CROSS and C. DORÉE (*London and New York: Longmans, Green & Co., 1922, vol. 4, pp. X+253, pls. 4, figs. 12*).—In this fourth volume of this series of critical reviews of the literature on cellulose (E. S. R., 30, p. 202), a period of 11 years, from 1910 to 1921, is reviewed.

The fermentation of pentoses by molds. W. H. PETERSON, E. B. FRED, and E. G. SCHMIDT (*Jour. Biol. Chem., 54 (1922), No. 1, pp. 19-34, fig. 1*).—A quantitative study is reported of the fermentation of the pentoses arabinose and xylose by various molds.

In a preliminary series of experiments the rapidity of fermentation of these sugars by 25 species of molds was determined, and from the results of these studies the more active fermenters were selected for a more extended study of mycelium growth and carbon dioxid evolution. The nutrient solution found most satisfactory was one recommended by J. B. Overton, and consisted of M ammonium nitrate 250 cc., M monobasic potassium phosphate 100, M magnesium sulphate 40, M ferric chlorid 2, and distilled water 608 cc. In the preliminary study 10 cc. of this salt solution was placed in a 100-cc. flask, which was then plugged with cotton and sterilized for 1 hour under 20 lbs. steam, after which 10 cc. of a previously sterilized 4 per cent sugar solution was added and the solution inoculated with the mold under investigation. In the later studies the concentration of sugar solution was kept at 4 per cent.

Of the 25 species studied, 16 fermented pentoses rapidly while the remaining 9 grew more slowly. Various strains of *Aspergillus niger* were particularly active and, with *Penicillium glaucum*, were selected for the later studies. Other strains of *Penicillia* and two *Mucors* fermented the pentoses very slowly.

But little difference could be noted between the availability of the two sugars for mold growth, although with slow fermenting molds xylose appeared to be somewhat more rapidly utilized than arabinose.

A comparison of the fermentability of the pentoses and glucose by some of the more vigorous molds showed that glucose in every case fermented more rapidly than either of the pentoses. After the first 48 hours, xylose was fermented more rapidly than arabinose.

Determinations of the quantity of carbon dioxid evolved and the weight and composition of the mold pads formed in the fermentation of xylose by two strains of *Aspergillus* and *P. glaucum* indicated that carbon dioxid represented from 40 to 70 per cent and mycelium from 28 to 47 per cent of the carbon of the xylose. The proportion of total carbon represented by carbon dioxid and mold varied with the species and age of the molds. *P. glaucum* produced about 70 per cent as much mycelium as *A. niger* and about 25 per cent more carbon dioxid. Tests for oxalic and citric acids, volatile and non-volatile acids, and alcohol were negative.

Modification of an improved anaerobe jar. J. H. BROWN (*Jour. Expt. Med., 35 (1922), No. 4, p. 467, fig. 1*).—On account of the tendency of the copper wires to corrode in the apparatus previously noted (E. S. R., 46, p. 180), suggestions are made for eliminating entirely the rubber connections which are thought to be responsible for this corrosion.

Indicators for culture media containing varying acids and buffers. I. W. HALL (*Brit. Jour. Expt. Path., 3 (1922), No. 4, pp. 182-186*).—This paper contains data on the buffer indices according to Brown (E. S. R., 46, p. 708) of various culture media containing small amounts of organic acids such as are likely to be formed during bacterial growth and also mineral acids which may be present in different buffers; the effects of storage and of added blood on the buffer indices in the presence of various acids; and a comparison of colorimetric and electrometric determinations of the H-ion concentration of the media.

These data show a slight increase in the buffer index in media containing added acids, no alteration on storage, and slight alterations due to added blood. In general the electrometric readings were slightly in excess of the colorimetric. Bromophenol blue, methyl red, and phenol red proved satisfactory indicators for media containing dilute quantities of mineral and organic acids.

[The H-ion concentration of different kinds of glassware when sterilized with buffered and nonbuffered solutions], F. W. FABIAN (*Michigan Sta. Rpt. 1921, pp. 173-178*).—Data are reported from a study by R. C. Stull of the changes in the H-ion concentration of buffered and nonbuffered solutions when sterilized in soft and hard glassware. For the nonbuffered solution triple distilled water was used and for the buffered solution a standard nutrient broth, both being adjusted to pH=7. The determinations of H-ion concentration following the different treatments were made colorimetrically with the Clark and Lubs indicators in a Cooledge comparator. The glassware used included soft glass tubes, hard glass tubes, 4-oz. druggists' bottles, Erlenmeyer flasks, Kolle flasks, and Smith fermentation tubes. Each kind of glass was divided into three sets. One consisted of new unwashed glassware. This was filled with the nonbuffered conductivity water and autoclaved for 30 minutes at 15 lbs. pressure and cooled, after which a 10 cc. sample was taken and its pH value determined. The same glass was then refilled four times with nonbuffered conductivity water and twice with broth, autoclaved after each time, and the pH value determined. A second series was run with the same kind of glassware, the conductivity water being used six times and the broth twice. In the third set the glassware was first filled with cleaning solution, heated 30 minutes in flowing steam, rinsed five times in tap water and once in distilled water, after which it was treated as in the first set of experiments.

Tabulated results showed that glassware taken from stock and filled with a nonbuffered solution yielded enough alkali during autoclaving to change the reaction from pH 7 to pH 9.8. The amount of alkali yielded by the same glass was not sufficient, however, to change the reaction of the buffered solution during autoclaving. The soft glass yielded more alkali on autoclaving than did the hard glass. Treatment of the glass with cleaning solution did not prevent its giving off alkali on autoclaving, but appeared to destroy or neutralize the substances that in some tests interfered with the action of the indicator. The practice of treating new glassware with cleaning solution before use is recommended on this account.

Tables for the microscopic identification of inorganic salts, W. H. FAY (*U. S. Dept. Agr. Bul. 1108 (1922), pp. 22*).—This publication consists of an explanation of the application of petrographic methods to the identification of inorganic salts and a series of tables giving the optical properties of a large number of complex salts.

Investigation of a volumetric tartaric acid method for the determination of potassium, W. A. ALBERTI-RAKHORST (*Dept. Landb., Nijv. en Handel [Netherlands], Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefsta., No. 26 (1922), pp. 89-95*).—A study is reported of the reliability of a volumetric method of determining potassium, the method consisting essentially in precipitating the potassium with sodium tartrate and tartaric acid, filtering off the precipitated potassium bitartrate, and titrating the excess tartaric acid with $N/10$ base. Results of duplicate determinations gave poor agreement and in all cases low values as compared with those obtained by the potassium chlorate method. Changes in temperature caused variations in results amounting to 0.074 per cent for each degree. Alkaline potassium salts could not be determined by this method. The composition and potassium content of the salts must be known roughly in order to use the right proportions of reagents. The author

concludes that the method is not practicable for use in laboratories where salts of varying composition must be analyzed.

The iodometric micro-determination of phosphoric acid and phosphorus in organic combination, O. SVANBERG, K. SJÖBERG, and G. ZIMMERLUND (*Arkiv Kemi, Min. och Geol.*, 8 (1921), No. 3-4, Art. 10, pp. 17, figs. 2).—The authors have applied the micro-Kjeldahl method of Bang to the determination of the ammonia content of the ammonium phosphomolybdate formed by the action of phosphomolybdic acid on compounds of phosphorus, and present data showing that the method has an error of from 2 to 3 per cent in the determination of phosphorus in simple organic compounds which contain from 0.05 to 1 mg. of phosphorus.

Examination of Thomas phosphate meal, M. J. VAN 'T KRUYSS (*Dept. Landb., Nijv. en Handel [Netherlands], Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefsta.*, No. 26 (1922), pp. 96-105).—On account of the fact that the greater part of the Thomas phosphate meal which is used in Holland is imported from other countries, a comparison was made of the method employed in various countries for determining the phosphoric acid content of the meal. The methods examined included the molybdic acid, citrate, Lorenz (E. S. R., 13, p. 14), uranium, and Grete (E. S. R., 22, p. 510) methods. The principal technique of each of these is outlined, and the results are reported of the analyses of a large number of samples by the different methods.

Data presented indicate that if the technique of each method is followed with care comparable results are possible. The Lorenz method is recommended as the quickest and simplest as well as the cheapest. Possible sources of error in the determination are suggested, including insufficient sample, lack of homogeneity in the sample, and the separation of the larger from the finer particles during transportation.

The alkalinity of the ash of foods.—I, The significance of alkalinity of the ash and methods for its determination, B. PFYL (*Ztschr. Untersuch. Nahr. u. Genussmitl.*, 43 (1922), No. 9, pp. 313-339; *abs. in Chem. Abs.*, 16 (1922), No. 20, pp. 3516, 3517).—This paper consists of a discussion of the significance of the alkalinity of the ash of foods; the influence of the presence of chemical preservatives and adulterants or diluents on the alkalinity, acidity, and phosphate values of the ash; methods developed by the author for the determination of these values; reasons for the technique employed; and a critical discussion of other methods.

In the author's method the ashing of the sample is in general carried out as follows: The sample is heated in the presence of $N/10$ sodium carbonate at a temperature not exceeding 700° C. until partial ashing has taken place. After cooling, a little water and a drop or two of pure neutral 30 per cent hydrogen peroxid are added, the mixture is evaporated and ashed, and the treatment with hydrogen peroxid is repeated. The ash is finally moistened with from 10 to 15 cc. of water, and after evaporation is ready for the determination of the methyl orange alkalinity. For this, the ash is moistened and treated with one or two drops of methyl orange solution, one drop of hydrogen peroxid solution, and a measured excess of $N/10$ hydrochloric acid. The mixture is washed into an Erlenmeyer flask, heated gently for 15 minutes, and, after cooling, is titrated with $N/10$ NaOH to a faint rose color. The phosphate content of the ash is determined by adding to the contents of the flask about 2 cc. of $N/10$ hydrochloric acid, concentrating the solution to from 10 to 15 cc., and neutralizing to methyl orange to a yellow end point. One drop of phenolphthalein solution is then added and an amount of 40 per cent calcium chlorid solution equal to two-thirds the volume of the solution. The solution is heated for a short time, cooled, and titrated with $N/10$ NaOH to a faint pink. Formulas are given for

calculating from these values the methyl orange alkalinity, phosphate value, and true alkalinity, the true alkalinity being the excess expressed in millival of the cations Na, K, Ca, and Mg above the normal requirements of the anions PO_4 , SO_4 , and Cl.

The examination of hydrocarbon oils and of saponifiable fats and waxes, D. HOLDE, trans. by E. MUELLER (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1922, 2. ed., pp. XIX+572, figs. 136*).—This is a translation of the fifth German edition of this work, the fourth of which has been noted previously (E. S. R., 30, p. 313).

Contribution to the detection of hardened vegetable oils in lard, W. MÜLLER (*Mitt. Lebensmitl. Untersuch. u. Hyg., Schweiz. Gesundheitsamt., 13 (1922), No. 4, pp. 208-217*).—The results are reported of the application of several tests to the detection of hardened vegetable oils in lard. The only one which proved at all satisfactory was a combination of the phytosteryl acetate and melting point difference tests of Bömer (E. S. R., 47, p. 806). No rapid color test has as yet been found to give reliable results.

A method for the determination of amino nitrogen and ammonia in cream and butter, L. W. FERRIS (*Jour. Dairy Sci., 5 (1922), No. 4, pp. 399-405*).—In the method described picric and acetic acid together are used to precipitate the proteins in milk, cream, buttermilk, and butter and thus separate them from the hydrolysis products. The amino nitrogen is then determined in the filtrate by the Van Slyke method. The technique for the precipitation as applied to cream and butter is as follows:

A 15-gm. sample is weighed into a 100-cc. flask, 5 cc. of 10 per cent acetic acid and 30 cc. of a saturated solution of picric acid are added, and the mixture is shaken for half an hour or at intervals for 2 hours. It is then filtered on a dry filter and 10 cc. of the filtrate taken for the determination of amino nitrogen in the Van Slyke apparatus. In the case of butter a 100-gm. sample is weighed in a 250-cc. ground glass stoppered bottle. The bottle is then filled to the shoulder with petroleum ether which has been warmed a few degrees above room temperature and the fat dissolved by shaking the tightly-stoppered bottle vigorously for a few seconds. The curd which is left after centrifuging and siphoning off the liquid is treated with 5 cc. of 10 per cent acetic acid and 30 cc. of a saturated solution of picric acid, and the treatment is continued as described for cream.

The accuracy of the method is shown by data obtained in the recovery from butter of known amounts of pure glutamic acid and some of the products formed by the acid hydrolysis of casein. Tables are also given of the results obtained with old and sweet cream when the determinations were made on the filtrates when freshly prepared and at daily intervals up to 16 days, and also when the mixture was allowed to stand without filtering for similar periods. It was found that there was no change in the amount of reacting nitrogen when the filtrate was kept at room temperature for 2 weeks, but that there was a slight increase in the amount of amino nitrogen when the mixture was allowed to stand for some time before filtering.

Tables are also given showing the relative percentages of amino nitrogen in sweet and decomposed cream and in samples of butter of varying quality. In the sweet cream the amino nitrogen was 2.2 per cent of the total nitrogen, in cream kept at room temperature for 6 days 5.8 per cent, and for 12 days 19.4 per cent. A sample of fresh butter from sweet cream gave an amino nitrogen figure of 1.4 per cent of the total nitrogen, fresh butter from neutralized sour cream 3.3, butter from neutralized sour cream held in cold storage 6 months and at room temperature 1 week 6.5, and the same sample after standing at room temperature for 1 month and 20 days 18.1 per cent.

A comparison of the picric acid method with several other methods of separating the proteins is also reported. In every case the picric acid procedure gave lower results and showed greater difference between samples of different quality.

The detection of pasteurized milk, W. D. FROST (*Wis. Univ. Studies Sci. No. 2 (1921), pp. 151-163, pls. 2*).—The methylene blue stain method for the detection of pasteurized milk previously noted (*E. S. R.*, 34, p. 113) is described in greater detail, with colored illustrations to aid in the interpretation of the results. The tendency of the dye solution to curdle the milk when used in the concentration originally recommended has been overcome by the use of a larger volume of a more dilute solution (1.5 gm. in 1 liter). This is added to the milk volume for volume. The mixture is allowed to stand for 10 or 15 minutes, after which it is centrifuged at 2,000 r. p. m. for 10 minutes. The sediment is then smeared carefully on a glass slide without the use of water, and the slide is examined first with a low power and finally with an oil immersion lens.

As noted in the original description of the method, the leucocytes of raw milk are unstained and appear as clear areas of irregular outline in a dark-blue field, while those of heated milk are of a much smaller size and more regular outline and their nuclei are stained a dark blue. The characteristic staining reaction occurs only when the milk has been subjected to a temperature of from 60 to 63° C. for 20 minutes or more. In general the bacteria in the raw milk are stained, but in freshly pasteurized milk they are invisible.

On the anaerobic and aerobic oxidation of xanthin and hypoxanthin by tissues and by milk, E. J. MORGAN, C. P. STEWART, and F. G. HOPKINS (*Roy. Soc. [London], Proc., Ser. B, 94 (1922), No. B 657, pp. 109-131, figs. 3*).—Evidence is presented and discussed that in the presence of methylene blue milk and certain animal tissues are able to bring about the oxidation of xanthin and hypoxanthin to uric acid under strictly anaerobic, as well as aerobic conditions. The process as studied in milk is highly specific, since no purin derivative other than xanthin and hypoxanthin is able to bring about this reduction.

Coal-tar and water-gas tar creosotes: Their properties and methods of testing, E. BATEMAN (*U. S. Dept. Agr. Bul. 1036 (1922), pp. 114, figs. 48*).—This publication is essentially a monograph on coal-tar and water-gas tar creosotes. Part 1 is introductory in character and includes definitions of the various terms used throughout the text and general descriptions of current methods for the manufacture of the two types of tar and for the production of creosote from tar. Part 2 consists of the detailed report of researches conducted by the author and coworkers on the physical and chemical properties of authentic coal-tar and water-gas tar creosotes. Part 3 consists of chapters discussing in detail the composition and physical and chemical properties of the two types of creosote and the theory concerning the mechanism of the protection of wood by oil solutions. Part 4 describes practical methods of testing creosotes and outlines specifications now in use by various associations for coal-tar creosotes, coal-tar solutions, and water-gas tar products to be used with zinc chlorid. A bibliography of 57 titles is appended.

The chemistry and technology of gelatin and glue, R. H. BOGUE (*New York and London: McGraw-Hill Book Co., Inc., 1922, pp. XI+644, figs. 119*).—This volume is essentially a monograph on the chemistry of gelatin and glue.

Part 1, which is devoted to theoretical aspects, consists of chapters on the constitution of the proteins, the chemistry of gelatin and its congeners, the physico-chemical properties and structure of gelatin, gelatin as a lyophilic

colloid, and gelatin as an amphoteric colloid. Part 2 deals with the manufacture, tests, chemical analyses, uses, and applications of glue and gelatin. In this part, as well as in the first, the subject is treated from the point of view of the chemist rather than of the plant technologist. The chapter on the manufacture of glue and gelatin is contributed by R. C. Shuey.

A concise description of the significance of H-ion concentration and the electrometric and colorimetric methods for its determination, together with various tables, is given in an appendix. The literature references are given mostly in the form of footnotes.

METEOROLOGY.

[**Meteorology in relation to agriculture**] ([*London: Gt. Brit.*] *Agr. Research Council, Met. Com. Rpt.*, pp. 17; *abs. in Jour. Min. Agr.* [*London*], 29 (1922), No. 5, pp. 432-436).—This is a report of the meteorological committee of the Agricultural Research Council, appointed in 1920 to investigate and make recommendations as to the fuller use of meteorological information in relation to agriculture and fisheries.

Attention is called to three ways in which the British Meteorological Office assists agriculture, (1) by providing information as to prevailing or recently prevailing weather, (2) by issuing weather forecasts, and (3) by research. It is stated that the office has not hitherto been in a position to do much direct research in agricultural meteorology.

The committee is of the opinion that the following three types of research should be encouraged: (1) Studies of the relationship between weather and harvests similar to those made by Hooker (*E. S. R.*, 19, p. 414), (2) more complete records of the state of crops in different districts at different stages of growth with special reference to the effect of the weather, and (3) more precise information as to what constitutes an optimum sequence of each element of weather for a particular crop and locality.

The effect of field vegetation on the wind, S. I. NEROL'SIN (*Trudy Moskor. Oblastn. Sel'sk. Khoz. Opytn. Sta. (Works Moscow Regional Agr. Expt. Sta.) Bul.* 1 (1922), pp. 17-32, 122).—This article, which is in Russian with an English summary, records and discusses observations on the variations in wind movement over fallow fields and fields of rye and oats of different heights and density of growth. It was found that even in the case of the sparse vegetation of fallow fields there was some retardation of the wind near the ground, and that the retarding effect increases with the height and density of the growth. The relations of the data to evaporation, soil ventilation, and the like are considered.

The local distribution of monsoon rainfall, G. T. WALKER (*Indian Met. Dept. Mem.*, 23 (1922), pt. 2, pp. 23-39, pls. 5).—This is the seventh contribution to the subject of correlation in seasonal variations of weather.

Summarizing his paper, the author states that the experience of the past 13 years shows that the formula of 1908 for forecasting the whole monsoon rainfall of India, which was based on data of snowfall accumulation, Mauritius pressure, South American pressure, and Zanzibar rainfall "affords a useful indication in years when the calculated departure is 1 in. or over, which on the average form about a half of the number of years. Investigation of the geographical distribution of rainfall leads to a subdivision of India into large homogeneous areas such as northwest India and the Peninsula, for which formulas have been worked out giving the total monsoon rainfall and that of August and September. The correlation coefficients range from 0.57 to 0.73.

Similar formulas have also been developed for Upper Burma, Mysore, and Malabar."

The preparation and significance of free-air pressure maps for the central and eastern United States, C. L. MEISINGER (*U. S. Mo. Weather Rev. Sup. 21 (1922), pp. 77, pls. 22, figs. 31*).—The study here reported "aims to carry the process of free-air reduction to the point where it can be performed at meteorological stations with a facility equal to that with which sea-level reductions are performed at present. The process is fully explained, the accuracy of the resulting maps is supported by much evidence, and a few specimen maps are drawn." The tests made of these maps indicated a reasonable degree of accuracy and that they would be a valuable and important adjunct to the forecaster's equipment.

An introductory chapter deals with the history and problems of American barometry.

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data, 9 (1922), Nos. 7, pp. [190], pls. 4, fig. 1; 8, pp. [189], pls. 4, fig. 1*).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for July and August, 1922, respectively.

Climatic conditions [on the Yuma Experiment Farm], E. G. NOBLE (*U. S. Dept. Agr., Dept. Circ. 221 (1922), pp. 4, 5*).—Summarizing observations on precipitation, evaporation, wind, temperature, and killing frosts on the Yuma Reclamation Project during 1919 and 1920, it is stated that "the season of 1919 was characterized by ideal weather for spring seeding, a favorable growing period during the summer months, and an exceptionally early killing frost (October 29). The frost-free period of 233 days for the year is the shortest recorded during 10 years. This early freeze greatly reduced the cotton yields on the project. . . . The year 1920 had a growing season, or frost-free period, of 345 days. This is the longest period recorded at this station. The last killing frost in the spring occurred on January 16; however, cool and windy weather continued far into the planting season." This proved detrimental to cotton and the alfalfa seed crop. "The highest temperature recorded for each of the two years was the same, 114° F. The lowest temperature in 1919 was 17.5°, and in 1920, 24°. The mean temperatures were approximately normal when compared with the 10-year average." The total annual evaporation was 74.17 in. in 1919 and 70.83 in. in 1920, as compared with a 10-year average of 75.87 in.

Meteorological tables, D. A. SEELEY (*Mich. State Bd. Agr., Ann. Rpt. Sec. 60 (1921), pp. 131-144*).—Daily and monthly summaries of temperature (maximum, minimum, and mean), precipitation, cloudiness, and sunshine, and monthly summaries of pressure (maximum, minimum, and mean), wind movement, and miscellaneous phenomena (frost, hail, thunderstorms, fog, auroras, and halos) at East Lansing, Mich., are given for the year ended June 30, 1921.

[Meteorological observations at Dickinson, N. Dak.], L. MOOMAW (*North Dakota Sta. Bul. 160 (1922), pp. 31, 32*).—Tables are given which summarize observations at this place on mean air temperature, length of frost-free period, and seasonal evaporation, April to September, 1907-1921; wind velocity, April to September, 1908-1921; and monthly, seasonal, and annual precipitation, 1892-1921.

Climatic conditions, C. H. RUZICKA (*North Dakota Sta. Bul. 158 (1922), pp. 5-14, figs. 6*).—The available observations at or near Williston, N. Dak., on precipitation, evaporation, temperature, and wind are summarized and briefly discussed.

The average annual precipitation, 1879-1920, has been 14.76 in. and for the five growing months, April-August, 10.15 in. The annual rainfall has varied from 23.25 in. in 1880 to 7.37 in. in 1884. "Comparatively wet years and comparatively dry years, singly or in series, have succeeded themselves in irregular order, and careful study of the data does not reveal when either may occur or can be expected." The average seasonal evaporation from a water surface during 10 years, 1909-1918, has been 33.094 in. The record of mean temperature for the growing months, April-August, show that "the highest monthly temperatures occur in July, the critical month for the grains, and the highest temperature on record, of 109° F., was experienced in July of 1917. July is the only month without frost in the long period since records are available." The average frost-free period since 1882 has been 121 days, May 19 to September 17. "The season has varied from as little as 81 days in 1883 to 155 days in 1905. Frosts have come as late as June 16, in 1915, and as early in the fall as August 21, in 1911. On the other hand, in 1896, the frost in the spring occurred on April 24, and the first fall frost came as late as October 11, in 1905."

The data indicate that "crops likely to be frosted should appear above the ground about May 19 at the earliest, and that varieties not mature by September 17 stand small chance of full production. This condition governs the varieties it is possible to grow successfully. Experience has proved early varieties of such crops as corn and potatoes to be more satisfactory."

The wind velocity decreases as the season advances, but with rare exception hot winds occur during June and July more or less every year. "They are of shorter duration and less damaging in seasons of abundant rainfall. Coming in the critical stage of the crop, they do serious damage in the dry years by unduly increasing the already great evaporation. In 1910, 1911, 1918, and 1919 the protracted hot winds cut down the yields more than lack of moisture. . . . The season of 1920 resembled the three preceding dry ones, except that less hot wind accompanied the extremely high temperatures. The only rain of more than 1 in. in the growing season came on June 22 with 2.3 in., with such force as to puddle the ground, beat down the crop, and largely run off. Yields were a little higher than in the two previous years, but corn suffered from the heat and few ears formed. On the whole, there was more feed produced in the Williston section that year than in any of the preceding three dry years. The frost-free period was long and the fall was open, but the soil was too dry to admit of much fall plowing."

SOILS—FERTILIZERS.

Climatic soil types, I. DE V. MALHERBE (*So. African Jour. Indus.*, 5 (1922), No. 7, pp. 291-298).—This is a brief scientific discussion in the Dutch language of the influence of climatic factors on the formation of soil types, with particular reference to South African soils.

Soil survey of the El Centro area, Calif., A. T. STRAHORN ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils*, 1918, pp. 59, pls. 4, fig. 1, maps 2).—This survey, made in cooperation with the California Experiment Station, deals with the soils of an area of 322,560 acres located in Imperial County in the extreme southern part of the Colorado Desert in southeastern California. The surface is said to be largely below sea level and includes a part of the sloping and slightly rolling area of the desert above an old beach line. It consists mainly of a more level uniform surface area below the beach line. The higher desert sections are drained by a number of characteristic shallow drainage ways that carry water only at long intervals.

Below the beach line practically all of the material of the soils is derived from the masses of sediments transported and deposited by the Colorado River during the time it flowed into this depression. The heavier types of these soils are prevaillingly purplish or chocolate brown to brown in color, very compact, and sharply stratified. The lighter textured soils are of a similar color or slightly lighter brown, but since their deposition have been subjected to redistribution by the action of the winds and have a rolling, hummocky, or dune surface. Above the old beach line the soils are prevaillingly light grayish brown to light gray or reddish and of sandy and gravelly textures to indefinite depths.

Including rough, broken land, dunesand, and riverwash, 24 soil types of 7 series are mapped, of which Holtville silty clay, Imperial silty clay, Meloland fine sandy loam, and Holtville silty clay loam cover 14.4, 12.7, 10.9, and 10.6 per cent of the area, respectively.

Irrigation is absolutely necessary for the growth of cultivated crops. Alkali is quite generally present in the soils below the old beach line, excepting where they have been formed largely by the action of the winds. Above the beach line the larger part of the soils are entirely free from alkali.

Soil survey of Orange County, Fla., J. E. DUNN ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. 111+25, fig. 1, map 1*).—This survey deals with the soils of an area of 575,360 acres lying within the Coastal Plain in the north-central part of the Florida Peninsula. The surface is said to vary from level to gently rolling and comprises a lake region in the north-western part and a flatwoods region in the eastern and southern parts. The drainage of the lake region is said to be generally good, although chiefly underground. That of the flatwoods region is very poor, and the soil is usually saturated and the stream flow sluggish.

The soils are grouped as regards origin as soils derived almost wholly from sedimentary materials and soils composed mainly of vegetable matter in various stages of decay, with only relatively small quantities of mineral matter. Including swamp, peaty muck, peat, muck, and water and grass, 15 soil types of 8 series are mapped, of which the Leon, Norfolk, and St. Johns fine sands cover 26.1, 18.4, and 13.6 per cent of the area, respectively.

Soil survey of Denton County, Tex., W. T. CARTER, JR., and M. W. BECK (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. IV+58, fig. 1, map 1*).—This survey, made in cooperation with the Texas Experiment Station, deals with the soils of an area of 602,240 acres lying mostly in the Grand and Black Prairie regions of northern Texas. The topography ranges from gently undulating to strongly rolling and hilly, the greater part of the surface being rolling. All parts of the country are said to be thoroughly drained.

The soils are said to be typically humid soils. They are of residual origin from consolidated and unconsolidated materials and of recent alluvial origin. Including rough, stony land, 34 soil types of 22 series are mapped, of which the San Saba clay, Denton clay, and Kirvin fine sandy loam cover 18.6, 13.2, and 10.5 per cent of the area, respectively.

A new muck soil problem and its solution, M. E. SHERWIN, R. B. ETHERIDGE, and A. DUNHAM (*Jour. Amer. Soc. Agron., 14 (1922), No. 5, pp. 212-215*).—In a contribution from the North Carolina State College of Agriculture and Engineering, the soil of an area of about 100 square miles, situated in Beaufort and Washington Counties, N. C., is described. The soil is muck, averaging about 4 ft. deep. The furrow slice drains well and is loose, but immediately below this the soil remains extremely wet. Corn roots will scarcely penetrate below the furrow slice.

Laboratory observations have indicated that the lime requirement is slightly in excess of 1 ton of calcium carbonate per acre-inch.

A comparison of soil from productive and unproductive spots in the area showed that the colloidal matter content is slightly higher in the productive soils than in the unproductive. The percentage of capillary water absorbed was very high for both soils, but was decidedly higher in the unproductive. Pending further investigation, ridged cultivation has been recommended to aid field practice, the object being to dry a maximum amount of the soil, thus limiting its colloidal matter and reducing its water-holding capacity.

Relation of hardpan to root penetration in the Great Plains, J. E. WEAVER and J. W. CRIST (*Ecology*, 3 (1922), No. 3, pp. 237-249, figs. 5).—Studies conducted at the University of Nebraska on root penetration in hardpan soils in the Great Plains are reported.

It is stated that a so-called hardpan exists in the soil over much of the Great Plains region at depths of from 1.4 to 3 ft. It varies in thickness from 8 in. to over 1.5 ft. In some localities it appears to be due largely or entirely to the calcareous nature of the soil, while in others it is clearly caused by the concentration and cementing effect of colloidal clay, aided in part by the carbonates. Water content determinations showed that the hardpan occurs at approximately the normal depth of water penetration. When moist it disappears, but reappears again upon the drying of the soil.

Available water was found to be the controlling factor of root extent in this region and occurs normally only above the hardpan. Thus the hardpan in general delimits the depths of penetration of crops, but under exceptional moisture conditions they may extend their roots from 5 to 6 ft. deep. Many of the native species are said to penetrate into the hardpan regularly, not only extending their roots through it but often several feet beyond. No modifications in root habit were apparent in the hardpan layer. Since roots will not grow far into dry soil, the logical explanation is considered to be that at some time during the life of these plants water must penetrate through the hardpan.

A tentative outline of the plate method for determining the number of microorganisms in the soil, S. A. WAKSMAN and E. B. FRED (*Soil Sci.*, 14 (1922), No. 1, pp. 27, 28).—In a joint contribution from the New Jersey Experiment Stations and the University of Wisconsin a tentative outline of methods to be used in determining the numbers of microorganisms in soils by the plate method is presented, which has been proposed by a committee appointed for that purpose by the Society of American Bacteriologists.

Movement of legume bacteria in soil, W. C. FRAZIER and E. B. FRED (*Soil Sci.*, 14 (1922), No. 1, pp. 29-35, figs. 4).—Laboratory and field studies conducted at the University of Wisconsin on the movement of legume bacteria in silt loam soil are reported. It is concluded that in soil of this type soy bean bacteria will spread slowly, if at all, unless carried by the host plant, wind, or rain.

The influence of soil reaction upon the growth of Actinomycetes causing potato scab, S. A. WAKSMAN (*Soil Sci.*, 14 (1922), No. 1, pp. 61-79, fig. 1).—Studies conducted at the New Jersey Experiment Stations are reported in which it was found that the limiting acid reaction for the growth of *Actinomyces scabies* in culture solutions, properly buffered, and in soil varied with the strain. For the majority of strains the limiting acid reaction was about pH 5-5.2. Some strains grew even at pH 4.8, while others began to develop only at pH 5.3-5.6. The saprophytic soil Actinomycetes seemed to be more acid resistant than the *A. scabies* strains. It was found that by the use of the proper amount of sulphur inoculated with *Thiobacillus thiooxidans* an acid reaction may be obtained which will control the growth of *A. scabies* in the soil.

The value of lime and inoculation for alfalfa and clover on acid soils, E. J. GRAUL and E. B. FRED (*Wisconsin Sta. Research Bul. 54* (1922), pp. 22, figs. 4).—Field and greenhouse studies with alfalfa and red clover on acid silt loam and sand soils to determine the influence of inoculation, liming, and phosphatic fertilization on crop growth are reported.

Calcium carbonate when applied to acid Colby silt loam which had not been cropped for many years increased the yield of and the total nitrogen in alfalfa. The largest applications did not always produce the largest yields. From 2.5 to 7.5 tons per acre of calcium carbonate gave increases in yield nearly as large as where larger applications were made. When three crops were added together, an increase of 70.3 per cent in crop yield and of 79.4 per cent in nitrogen content resulted where 10 tons per acre of calcium carbonate were added. The percentage of nitrogen in the limed series was increased with few exceptions. The addition of phosphorus and potassium to virgin Colby silt loam did not give increases sufficient to warrant recommending their use for alfalfa.

The results obtained in the greenhouse when cropped Colby silt loam was used indicated that these soils need inoculation, liming, and undoubtedly in many cases phosphatic fertilization. Inoculation alone increased the yield 15.6 per cent, and where liming and inoculation were supplied the increase amounted to 49.7 per cent. Where the soil was treated with lime and inoculated, the increase in nitrogen content amounted to 52.3 per cent.

Very marked increases in crop yields and in nitrogen resulted from inoculation and liming and the use of phosphorus and potassium on Plainfield sand. Inoculation alone nearly doubled the crop yield. Calcium carbonate in addition to inoculation resulted in increasing the yield 182.8 per cent.

The nitrogen of the crops that were inoculated was 171.2 per cent greater than that of the untreated control. Where 2.5 tons per acre of calcium carbonate were added in addition to inoculation, the increased crop yield was 310.7 per cent more than the control. In nearly every case inoculation increased the percentage of nitrogen in the roots.

Because the soil was naturally infected with the clover bacteria, this crop did not show a uniform gain in yield and nitrogen from inoculation. The addition of phosphorus and potassium greatly increased the yield and total nitrogen. Where lime was added in addition to phosphorus and potassium, no material increase in crop growth and nitrogen content resulted.

Field studies indicated that Colby silt loam soil requires inoculation and liming before good crops of alfalfa can be grown. Inoculation of soil at Marshfield resulted in a crop increase of 67.1 per cent. When inoculation was reinforced by liming, the increase amounted to 120.4 per cent. The inoculated crop contained 87.7 per cent more nitrogen than did the control. The crop grown on inoculated soil treated with 3 tons per acre of ground limestone contained 160.2 per cent more nitrogen than did the control. The percentage of nitrogen was markedly increased by inoculation. On the cropped Colby silt loam at Curtiss inoculation alone increased the crop yield 56.3 per cent.

A study of the nitrogen content of the soils at the beginning and at the end of the experiments showed that a large percentage of the nitrogen in the crops comes from the soil. In only a few cases was there an actual gain in nitrogen to the soil due to cropping to alfalfa and clover (portion above ground cut and removed), and most of these gains were in the Plainfield sand. Inoculation for alfalfa and in some cases for clover increased the amount of nitrogen fixation from the air by these plants.

A possible correlation between the fertility of rice soils and their titration curves, O. ARRHENIUS (*Soil Sci.*, 14 (1922), No. 1, pp. 21-26, figs. 3).—

Studies conducted at the Treub Laboratory, Buitenzorg, Java, in an attempt to solve the question as to how rice soils become unproductive, through an investigation of the H-ion concentration, are reported.

The results of colorimetric determinations of the pH values of several soils of different types did not show any correlation between the pH values and the nature of various soils as regards productivity except in two instances. The four most acid soils were unproductive, and the five most alkaline were of high productivity.

A determination of the titration curves of various soils and of their so-called buffer effect indicated a very distinct correlation between the buffer capacity and the productivity of the soil. The soils which acted as good buffers were also good soils for rice cultivation.

Further studies of rice plants in nutrient solutions showed that the root excretions neutralized the acids or alkalis in the nutrient solution to a specific point and thus acted as amphoteric electrolytes.

Studies of samples of soils with a low buffer content taken partly from the soil surrounding rice plants and partly from within the root system showed that the latter samples had a lower pH value than the former. This is taken to indicate that the plant acidified the root layer, resulting in a marked change in H-ion concentration.

It is concluded that it is an acid reaction which prevents rice from growing, and not the fact that a soil is rich in humus. By adding lime to the humus a good buffer substance of the proper reaction can be produced.

Influence of soil colloids on availability of salts, N. E. GORDON and E. B. STARKEY (*Soil Sci.*, 14 (1922), No. 1, pp. 1-7, fig. 1).—Laboratory studies conducted at the University of Maryland on the colloidal adsorptive powers of certain soils and to determine the relation between the H-ion concentration and adsorption are reported. Hydrogels of silica, alumina, and iron were prepared in the purest possible condition, and the salts used in the adsorption work were the nitrate, sulphate, and acid phosphate of potassium, calcium, and magnesium.

Silica gel showed small adsorption for salts like calcium acid phosphate, while the alumina and iron gels showed large adsorptive powers. Within the limits of the concentrations used, the adsorption increased with the concentration of the salt solution. The colloids gave up their adsorbed salts gradually. It was found that one of the factors affecting the solubility, and therefore the availability of some ions like potassium and calcium in certain forms, is the H-ion concentration.

The importance of exchangeable soil potassium for plant nutrition, A. VON NOSTITZ (*Jour. Landw.*, 70 (1922), No. 1, pp. 45-71, pls. 2).—Vegetation studies with different grain and grass crops are reported which showed that, aside from the water-soluble potassium, the crops were limited to the potassium exchangeable with ammonium nitrate in soils in their assimilation of potassium. This was true in spite of the presence of a normally sufficient amount of potassium soluble in hydrochloric acid in soils. A chemical analysis of soils for potassium and a determination of their base-exchanging properties are considered to be profitable procedures in this connection.

Germination experiments showed that in the course of the germination and growth of seedlings in a nutritive solution containing no potassium there was a transfer of potassium from the seedling to the solution. The plants were able from the first day of their germination to assimilate mineral matter. The assimilation of potassium occurred apparently in a certain ratio to lime and magnesia. This is taken to indicate the importance of considering the ratio

of the potassium content to the contents of the other nutritive constituents of the soil when determining the fertilizer requirements.

Variation of nitrate nitrogen and pH values of soils from the nitrogen availability plats, A. W. BLAIR and A. L. PRINCE (*Soil Sci.*, 14 (1922), No. 1, pp. 9-19, figs. 2).—Studies on the variations in pH values and nitrate nitrogen in the soil of the nitrogen availability plats at the New Jersey Experiment Stations during and immediately following the growing season are reported. The soil is a loam but inclines to the gravelly phase. The rotation is a general farm crops rotation, including corn, oats, wheat, and timothy for two years without legumes. Both limed and unlimed soils were studied.

H-ion determinations on soil samples collected at intervals of two weeks over a period of nearly five months showed only slight variations in pH values for a given fertilizer treatment. On the unlimed soils the pH values varied considerably according to the fertilizer treatment given the different plats. The variation was much less for the same treatment on the limed section. The pH values were quite consistently lower on the unlimed than on the limed plats. The lowest pH values for both sections were found on the ammonium sulphate plat, but the soil from the unlimed plat was much more acid than that from the limed plat.

The plat having the lowest pH value throughout the period showed the highest lime requirement by the Veitch method. The unlimed sodium nitrate plat showed a slightly higher pH value than most of the other plats in this section and a lower lime requirement. Those plats which gave a pH value of about 7 showed no lime requirement by the Veitch method. It is concluded that for normal soils a determination of the pH values may be of considerable assistance in arriving at the amount of lime required for general farm crops.

Biweekly nitrate determinations showed considerable variation as the season progressed, the lowest period being about the last of July and through August, just after the crop had been removed. The average nitrate contents for the unlimed plats were, with some exceptions, higher than the averages for the limed plats. A high nitrate content was not necessarily accompanied by a good crop yield. It is stated that nitrates may be found in considerable quantities in a soil which is so acid as to practically inhibit the growth of ordinary farm crops. There appeared to be a slowing down of nitrification with the approach of freezing weather.

[**Soil studies at the Florida Station**], R. W. RUPRECHT (*Florida Sta. Rpt.* 1921, p. 23).—Studies to determine the changes in soil and the points of accumulation of fertilizer constituents in soils subjected to a 10-year drainage water study showed that most of the lime had been removed from the soil, the amount dropping from an average of 0.3 per cent in 1910 to 0.03 per cent in 1920. This loss took place despite the fact that some lime was applied yearly in the acid phosphate. Of the three elements nitrogen, phosphoric acid, and potash, the last was the only one to show a loss during the ten years. The ammonia content remained about the same, while the phosphoric acid content increased slightly. The amount of organic matter or humus decreased in the first 21 in. The decrease in humus also decreased the percentage of ammonia in the first 2 ft., but this was counteracted by an increase in the third and fourth foot. The decreased humus content also caused the percentage of iron and aluminum to increase in the first 21 in. The actual amount of iron and aluminum did not increase, the decreased amount of humus simply increasing the relative amounts of iron and aluminum. The sulphates increased in all the layers, but much more in the lower layers than near the surface. The tank receiving its ammonia from ammonium sulphate showed no more sulphates

in the soil than did the tank receiving its ammonia as dried blood. On the whole, most of the plant food was found within 9 in. of the surface, the amount gradually decreasing with the depth.

The lysimeters or drain gauges [at Craibstone] (*North of Scot. Col. Agr., Guide Hapts. Craibstone, 1922, pp. 32, 33*).—This is a progress report on the losses of fertility constituents from the soil under different cropping and fertility treatments, as indicated by the Craibstone lysimeter experiments (E. S. R., 46, p. 811).

Soils, Z. N. WYANT (*Michigan Sta. Rpt. 1921, p. 169*).—The first year's results of a microbial peat decomposition experiment, using buckwheat as an indicator of microbial activity in peat soil, are said to have shown that manure organisms caused a marked increase in the yield of seed. With peat alone the yield was 3 bu. per acre, while with peat inoculated with manure organisms it was 104.8 bu. With peat plus rock phosphate the yield of buckwheat seed was at the rate of 44.3 bu. per acre, and with the same combination plus manure organisms it was 101.1 bu.

With a compost containing peat, rock phosphate, and manure the yield was 58.3 bu. per acre. With a second compost of peat and rock phosphate, using the first compost as an inoculum, the yield was 80.7 bu., while with a compost containing sulphur in addition to the peat and rock phosphate it was 94.5 bu. per acre. Either sulphur or rock phosphate, a combination of the two, or sand were found to be desirable adjuncts to peat. The particular type of clay used, however, seemed to depress yields in most cases. The stimulating or depressing action, respectively, of the various additions seemed to affect the microbial flora, especially particular types.

As a rule, composted peat seemed slightly better as a soil than raw peat to which compost or other materials were added, but this was not sufficiently marked to advise its use in agricultural practice. From the standpoint of seed yield it was found to be profitable to compost peat with rock phosphate before using it as a soil or a fertilizer.

Fertility trials, C. H. RUZICKA (*North Dakota Sta. Bul. 158 (1922), pp. 84-87*).—Experiments begun in 1913 to compare methods of maintaining soil fertility under northwestern North Dakota conditions and to determine the relative value of farm manure and farm manure reinforced with phosphorus, potassium, and ground limestone are briefly described. Manure alone gave the best results with wheat and corn during the period from 1914 to 1919, inclusive, followed closely by manure reinforced with steamed bone meal. The differences in yields from combinations of fertilizers were insignificant, but indicated no deficiency of either phosphorus or potassium in the soil.

The results of three years of an experiment begun in 1918 to compare top-dressing with plowing under of fresh and rotted manure for wheat, oats, and corn are briefly presented, no conclusions being drawn.

On the change of soil reaction by manuring, I. S. ŌSUGI and N. SOYAMA (*Ber. Ōhara Inst. Landw. Forsch., 2 (1921), No. 1, pp. 79-93*).—The results of preliminary studies on the influence of varied fertilization on the reaction of soils growing different crops are presented.

While no conclusions are considered justified from the results of two years of experiments, it was found that in every case where ammonium sulphate, superphosphate, and potassium sulphate were applied to barley soils there was an alkaline reaction with one exception, and the difference in the soil reaction between two corresponding plats was not so distinct and regular as might be expected from the chemical and physiological reaction of each manure. The effect of the alkalinity of lime, lime nitrogen, and wood ash was readily

observed. The continuous application of the same fertilizer to the same soil did not seem to cause any accumulation of the reaction produced. The effect of the alkalinity of lime, lime nitrogen, and wood ash was not so distinct in rice field soils as in barley field soils. The tentative conclusion is drawn that in the case of paddy rice fields where the irrigation water has a distinct reaction, the effect of a fertilizer reaction upon soil, if it exists, is overcome by that of irrigation water.

Studies on the influence of stable manure on the decomposition of cellulose in agricultural soils, C. A. G. CHARPENTIER (*Meddel. Centralanst. Försöksv. Jordbruksområdet*, No. 218 (1921), pp. 41, figs. 7; also in *K. Landtbr. Akad. Handl. och Tidskr.*, 60 (1921), No. 7, pp. 567–603, figs. 7).—Studies on the influence of cow and horse manures and lime on the decomposition of cellulose in two different clay soils of varying moisture content and in sand and moor soils are reported. The influence of ammonium sulphate was also studied in clay soils.

The addition of 2 per cent of cow or horse manure caused marked stimulation of cellulose decomposition in soils of sufficient moisture content. The influence of the manures in this respect depended upon their content of plant nutrients and upon the moisture and nutrient contents of the soil. The influence of the manure increased as its content of nutrients increased, or as the content of nutrients in the soil decreased. The speed of decomposition of the cellulose in soil increased as the absorptive power of the soil for water increased without excluding air. The influence of the manure also increased under such conditions.

The manure strongly stimulated cellulose decomposition in a clay soil containing 30 per cent of water. When the water content decreased to 10 per cent, only the cow manure showed any influence and this was very weak.

The addition of 0.5 per cent of calcium oxid in the form of calcium carbonate exercised in general only a small influence on cellulose decomposition in soil. This is taken to indicate that the lime did not act as a regulator of the soil reaction. However, the addition of lime to soils deficient in lime increased the action of the stable manure.

When 0.015 per cent of ammonium sulphate was added to soils the decomposition of cellulose was hastened. Cow manure and ammonium sulphate produced about the same results when added to soils in equivalent amounts as regards ammonia content. This is taken to indicate that the favorable influence of cow and horse manures on cellulose decomposition in soils is due to their ammonia content.

Studies in methods to prevent nitrogen losses from dung and urine during storage, N. V. JOSHI (*Agr. Jour. India*, 17 (1922), No. 4, pp. 367–374).—Further experiments on the storage of dung and urine under different conditions are reported (*E. S. R.*, 44, p. 511), in which it was found that the losses of nitrogen from cattle dung when stored separately are small under both aerobic and anaerobic conditions. In the case of urine great amounts of nitrogen were found to be lost under aerobic conditions, while under anaerobic conditions the losses were negligible.

Covering the surface of the urine with a layer of some kind of oil such as kerosene, mustard, or coconut oil brought about the necessary anaerobic conditions, and this method proved effective in preventing nitrogen losses. Among several substances tried to prevent losses of nitrogen from urine occurring under aerobic conditions of storage, sulphuric acid, superphosphate, and formalin proved effective, but their cost is thought to be prohibitive in practice.

Very great losses of nitrogen were observed when straw and soil were used as absorbents for urine. Since greater losses of nitrogen occur in the mixture

of cattle dung and urine, it is considered advisable to store them in separate pits instead of following the prevalent practice of mixing.

Reinforcement of farm manure, M. E. McCOLLAM (*Western Washington Sta. Bimo. Bul.*, 10 (1922), No. 4, pp. 66, 67).—Brief information on the proper reinforcement of farm manure with phosphatic materials is presented.

Farm manure and commercial fertilizers, E. S. HOPKINS (*Canada Expt. Farms, Div. Field Husb. Interim Rpt.*, 1921, pp. 12–18, fig. 1).—Experiments begun in 1910 to determine the value of barnyard manure and commercial fertilizers when applied to a 4-year rotation of mangels, oats, clover hay, and timothy hay are described, and the results are summarized and discussed.

In a 5-year study of farm manure it was found that the manure produced a profit on 4 acres of land of \$391.29 during the period. During a 5-year study of commercial fertilizers an investment of \$142.32 gave an increased crop valued at \$318.03, leaving a net profit of \$175.71. The practice of supplementing farm manure with commercial fertilizers was found to be very profitable where the supply of farm manure was insufficient to permit the ordinary application per acre.

A study of present and future supplies of fertilizer nitrogen, S. B. HASKELL (*Jour. Amer. Soc. Agron.*, 14 (1922), No. 5, pp. 167–178).—In this contribution from the Massachusetts Experiment Station it is pointed out that the most salient aspects of the nitrogen problem are a probably decreasing supply of organic nitrogen, a present greatly increased supply of by-product inorganic nitrogen with indefinite potentialities for enlargement, a maintenance for an uncertain but probably a long period of years of the production of primary mineral nitrogen, and in the future a possible greatly enlarged supply of primary manufactured nitrogen produced by transforming power resources into fertilizer ammonia.

From the economic viewpoint the three enormous wastes existing are considered to be the consumption of human labor in the fruitless tilling of soils, the waste of the kinetic energy of falling water, and the waste of the nitrogen resources through the destructive and wasteful methods of utilization of bituminous coal.

Muscle Shoals (*U. S. Senate, 67. Cong., 2. Sess., Com. Agr. and Forestry, Hearings on S. 3420, 1922, pp. [2]+949*).—The minutes of these hearings are presented.

The nitrogen inventory as affected by live stock v. grain farming, C. G. WILLIAMS (*Jour. Amer. Soc. Agron.*, 14 (1922), No. 5, pp. 159–162).—The results of a study begun in 1910 at the Ohio Experiment Station to compare live stock with grain farming on silt loam soil are summarized. The results indicate that the live-stock system results in slightly larger yields of crops year by year and in a moderate increase in the nitrogen content of the soil.

Agricultural and commercial values of nitrogenous plant foods, A. W. BLAIR (*Jour. Amer. Soc. Agron.*, 14 (1922), No. 5, pp. 162–167).—In a contribution from the New Jersey Experiment Stations the results of field and cylinder experiments, covering periods varying from 5 up to 20 years, and comparing mineral and organic sources of nitrogen, are briefly summarized.

In the field experiments the mineral materials in every case gave larger yields and larger nitrogen returns than the organic materials. While the differences were not great, they are considered to be sufficient to indicate that the organic materials do not have greater lasting properties than the mineral.

A comparison of green manure and stable manure in cylinder experiments gave results favoring the green manure. In the meantime the soil in the green manure cylinders was kept on a level with, and in some cases on a higher plane as regards nitrogen content than, the soil in the stable-manure cylinders.

A 20-year comparison of sodium nitrate with dried blood in cylinder experiments showed that the yields obtained with sodium nitrate were greater for the second 10-year period than for the first, while the reverse was true with the dried blood. The difference in the amount of nitrogen recovered was greatly in favor of the sodium nitrate. A comparison of sodium nitrate with dried blood in a 50 per cent sand and loam soil mixture, extending over a period of 9 years, showed that the yield of dry matter and the nitrogen recovery were both decidedly in favor of the nitrate nitrogen. These results are taken to indicate that the loss of nitrate nitrogen through leaching is not greater than the loss of organic nitrogen from the same cause.

In a consideration of commercial values it is pointed out that nitrogen in organic materials has cost more than nitrate and ammonia nitrogen. It is concluded that the commercial values of organic nitrogenous materials should be made more in keeping with their agricultural values, as shown by long-time vegetation tests.

The phosphoric acid question, K. KUFFNER (*Mitt. Deut. Landw. Gesell.*, 37 (1922), No. 34, pp. 512, 513).—Several years' study of German soils rich in phosphoric acid but showing cultural indications of a deficiency in phosphoric acid are said to have shown that the lime-magnesia ratio of the soil has a marked influence upon this condition. Soils rich in phosphoric acid but containing more than two and one-half times as much lime as magnesia showed a deficiency in phosphoric acid in cropping experiments. This is attributed to the lower solubility of the calcium phosphates as compared to the magnesium phosphates. Where the soil contained less than 0.1 per cent of phosphoric acid, superphosphate was used with good results. Where as much or more than 0.1 per cent of phosphoric acid was present and the lime-magnesia ratio was narrower than 1 to 2.5, no phosphoric acid fertilization was required. When the lime-magnesia ratio broadened beyond 1 to 2.5 on such soils, phosphoric acid deficiency was evident and fertilization with this nutrient was necessary.

Composting rock phosphate with sulphur in slightly alkaline calcareous soils, W. RUDOLFS (*Soil Sci.*, 14 (1922), No. 1, pp. 37-59, figs. 3).—Studies conducted at the New Jersey Experiment Stations are reported which showed that sulphur oxidation takes place in a calcareous, slightly alkaline soil and that the solubility of the phosphoric acid is not hindered. Compost mixtures incubated at 30° C. increased more rapidly in relative acidity and available phosphoric acid than composts kept at room temperature. When larger quantities of a calcareous soil were used the influence of temperature was usually greater than when small amounts of such soil were employed. The influence of light was slightly detrimental to sulphur oxidizing organisms.

Small quantities of sulphuric acid stimulated bacterial activities, particularly during the first weeks of the incubation period, if a calcareous, slightly alkaline soil was used. Sodium bicarbonate stimulated the bacterial activities considerably when a calcareous soil deficient in organic matter was used. A similar soil rich in organic matter failed to produce stimulation to the same extent, presumably due to greater carbon dioxide production. Sodium bisulphate in solution and acetic acid had no stimulating influence but rather a detrimental one. A mixture of 0.02 per cent of ferrous sulphate and 0.02 per cent of aluminum sulphate failed to exert any influence.

Partial sterilization of the soil and of the mixtures by additions of sodium chlorid and hydrochloric acid proved to be of no value. Sodium chlorid retarded the activities of the sulphur oxidizing organisms, and the same was true to a less extent with hydrochloric acid. It was possible to replace the

bulk of a calcareous soil poor in nitrogenous material with ammonium sulphate. The quantities of sulphur in the mixtures, reduced to approximately the amounts required in ordinary factory methods of making acid phosphate, gave good results. The addition of small amounts of sulphurous acid to change the initial reaction of these mixtures, in which a slightly alkaline calcareous soil was used, decidedly influenced the rapidity of the accumulation of acidity and available phosphoric acid.

Aeration of the mixtures had considerable influence, but when they received an abundance of air sulphur oxidation nearly ceased and no phosphoric acid was made available. The H-ion concentration in the mixtures changed until pH values of from 3.1 to 2.9 were reached, thus indicating the point at which phosphoric acid becomes available most rapidly. Relative acidity, as measured by the titration method, accumulated after this point was reached. The mixtures had a tendency to form aggregates which had a different relative acidity and different quantities of available phosphoric acid according to the size of the crumbs.

Experiments with liming of soils injurious to plants, H. VON FEILITZEN and H. G. SÖDERBAUM (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 222 (1921), pp. 14, figs. 3; also in K. Landtbr. Akad. Handl. och Tidskr., 61 (1922), No. 1, pp. 19-29, figs. 3*).—It was found that the silt obtained from the cleaning of a river bed when spread over the surrounding agricultural soils either reduced or practically destroyed their productiveness. The silt had a high H-ion concentration, the pH value in some cases being as low as 3. Chemical analyses revealed the presence of considerable quantities of sulphate salts, which is attributed to the oxidation of iron sulphids in the silt to iron sulphate and sulphuric acid.

Laboratory and field experiments showed that lime was required in amounts equivalent to 10,000 kg. of calcium oxid per hectare (8,900 lbs. per acre) to remove the injurious influence of the decomposition products of the iron sulphids. Even better results were given by applications of 20,000 kg. per hectare.

The injurious influence of excessive liming was overcome by seeding some time after the lime was plowed under. This was unnecessary where calcium carbonate was used.

Influence of liming of cultivated and grassland peat soils on the losses of plant nutrients by leaching, H. VON FEILITZEN, H. HJERTSTEDT, I. LUGNER, and E. NYSTRÖM (*Svenska Mosskulturför. Tidskr., 35 (1921), No. 4, pp. 189-208*).—Five years' lysimeter experiments conducted at the Jönköping Experiment Station from 1914 to 1918, inclusive, on the losses by leaching of plant nutrients from limed and slightly humified peat soils deficient in lime are reported.

These showed that with a normal liming of 3,000 kg. of slaked lime per hectare (2,670 lbs. per acre) the losses of plant nutrients were greater from the soils of both cultivated fields and grasslands than from unlimed soils. Liming seemed to increase humification and consequently the losses of organic matter. The losses of plant nutrients were greater from limed cultivated soils than from limed grasslands.

Commercial fertilizers in 1921-22, G. S. FRAPS and S. E. ASBURY (*Texas Sta. Bul. 298 (1922), pp. 3-23*).—This bulletin contains manufacturers' guarantees and the results of actual analyses and relative valuations of 375 samples of fertilizers and fertilizer materials collected for inspection in Texas for the season 1921-22, together with a list of brands registered for sale during the season. Data showing the relation of guaranteed valuation to selling price and to actual valuation are also presented.

AGRICULTURAL BOTANY.

Botanical exploration of French West Africa, A. CHEVALIER (*Exploration Botanique de l'Afrique Occidentale Française. Paris: Paul Lechevallier, 1920, vol. 1, pp. XV+798, pls. 2*).—The first section of results obtained from explorations carried on in French West Africa and extending over the period 1898–1912, inclusive, having in view the collection of information regarding the agricultural and forest resources of the region explored, are presented. Volume 1 enumerates and locates plants collected in Mauretania, Sahara oases, Senegal, Kasamanze [river], French Guinea, French Sudan, Ivory Coast, Dahomey, Gold Coast, Sierra-Leone, Lagos, and Old Calabar.

Yellow-white pine formation, L. R. H. HARVEY (*Bot. Gaz., 73 (1922), No. 1, pp. 26–43, figs. 6*).—This paper is limited to a consideration of certain aspects of the Big Pines formation exhibited at Little Manistee in Lake Co., Mich.

On the basis of the data presented, it is supposed that the original stand of the Big Pines extends back some 400 or 450 or more years, and doubtless the formation had then been self-perpetuating for centuries. The break in age between the persisting patriarchs and the present stand (mostly under 200 years of age) is very striking, although bridged somewhat by a broken series of isolated trees. The explanation of this break in history appears to be that there had been an almost entire destruction of this formation some 200 years ago, possibly through fire of lightning origin, which then became reestablished through a few isolated individuals of various ages escaping the devastation. The well distributed range of ages down to 30 years would apparently indicate that the formation has been and is under natural conditions permanently self-perpetuating, representing an ecological climax formation.

Grafts of the sunflower on Jerusalem artichoke, L. DANIEL (*Compt. Rend. Acad. Sci. [Paris], 172 (1921), No. 10, pp. 610–612*).—An attempt is made to ascertain or estimate the work done (particularly reserves formed) by the graft and stock, respectively, in the case of *Helianthus orgyalis* grafted on Jerusalem artichoke.

[**Breeding experiments with peas**], J. DE VILMORIN (*Compt. Rend. Acad. Sci. [Paris], 172 (1921), No. 13, pp. 815–817*).—Study of peas demonstrated Mendelian behavior as regards the characters here dealt with, supporting the hypothesis of latent characters or cryptomeres.

Photocatalysis.—II, The photosynthesis of nitrogen compounds from nitrates and carbon dioxide, E. C. C. BAILY, I. M. HEILBRON, and D. P. HUDSON (*Jour. Chem. Soc. [London], 121 (1922), No. 716, pp. 1078–1088*).—The preliminary results announced in the previous paper (E. S. R., 47, p. 728) have been followed by results of interest, some of which are reserved for later publication. The present paper deals with the formation of the complex nitrogen derivatives in the living plant, the question being whether the plant is able to synthesize from potassium nitrate or ammonium salts, or both, by the use of activated formaldehyde, the many complex nitrogenous substances that have been found in the vegetable kingdom.

The authors restrict this account to the work with potassium nitrate, the results from which are thought to leave no doubt that the activated formaldehyde photosynthetically produced in the living chloroplast reacts with potassium nitrite with extraordinary ease to produce formhydroxamic acid, which at once proceeds to condense with more of the activated formaldehyde to give various nitrogen compounds. It follows from this that the synthesis of the nitrogen compounds found in the plant is not photosynthetic except in so far as the production of the activated formaldehyde by the chlorophyll is con-

cerned. The various amino-acids, proteins, alkaloids, etc., are natural and indeed inevitable results of the photosynthesis of formaldehyde in the presence of potassium nitrite. The life and growth of a plant consist in the utilization of the products formed in its leaves. In the formation of these products under the given conditions of chlorophyll, carbon dioxid, light energy, and potassium nitrite the synthesis must follow its natural course, just as has been found to take place in vitro. The region where the synthesis occurs must necessarily be restricted to the leaves, the compounds being subsequently distributed as soluble glucosids by the normal translocatory processes.

The authors direct attention also to the fact that in the various stages of the nitrogen synthesis oxygen is evolved. They note the presence of the enzym catalase in the leaves which has the power of accelerating the loss of oxygen by various compounds. Possibly it is this enzym that causes the reduction of potassium nitrate to nitrite. The escape of oxygen in the various stages of the nitrogen synthesis is therefore certainly not antagonistic to the conditions known to exist in the plant. The evolution of oxygen in these experiments was proved by the oxidation of considerable quantities of formaldehyde to formic acid.

Variation in organic acids in the course of anthocyanin pigmentation. D. KOHLER (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 11, pp. 709-711).—It was found that, as regards organs still in relation with the plant, the formation of anthocyanin may be correlated with an increase of organic acids as in corollas of *Cobaea scandens* and leaves of *Ampelopsis tricuspidata*, or sometimes with a decrease as in stems of *Polygonum fagopyrum*. In detached organs, the formation of anthocyanin is not always correlated with an increase of organic acids. These facts are discussed.

The carbohydrate content of the seed of *Asparagus officinalis*. W. E. CAKE and H. H. BARTLETT (*Jour. Biol. Chem.*, 51 (1922), No. 1, pp. 93-102).—An examination of the seed of the variety Palmetto of *A. officinalis* has shown that the reserve carbohydrate is in the form of hemicelluloses, which give on hydrolysis mannose, glucose, fructose, and galactose. The proportion of galactose is small. Mannose is in a ratio of 1:1 to the total remaining hexoses.

Chemical changes in coffee leaves killed by cold. T. DE ALMEIDA CAMARGO (*Escola Agr. "Luis de Quetroz," Piracicaba, Brazil, Bol.* 8 (1921), pp. 17).—Following the freeze of June 25-26, 1918, at São Paulo, causing much loss particularly to growers of coffee (*Coffea arabica*), which suffered death or injury amounting to 80 per cent or more of the value of the trees, an attempt was made to ascertain the chemical differences between leaves which died and those (often on the same branch) which withstood the cold. The object was to establish, if possible, the cause of resistance or of death, looking to the separation of more resistant forms.

The results of these studies as tabulated with discussion indicate that the death of the leaves after freezing is not due to the mechanical action of ice crystals but to the concentration of the cell sap owing to the withdrawal (by crystallization) of water. The cellular enzymes continue to act for some time after the death of the protoplasm, producing a synthesis of nitrogenous substances and an increase of certain bases. The carbohydrates are hydrolyzed with the formation of sugars, which accumulate in the leaves as a consequence of the lowering of the respiration rate due to the chilling. The plants richest in carbohydrates due to the action of cold are most able to resist its ill effects in ways indicated. Carbohydrates, therefore, are under these conditions correlated with resistance to cold. Addition of potassium and phosphorus manures increase resistance, while nitrogenous compounds have the opposite effect as

they augment cellular respiratory activity, thus lowering the sugar content of the cells. Excessive soil humidity at the beginning of winter is also prejudicial, favoring the storing of carbohydrates in reserve tissues.

It is considered possible, by selecting coffee varieties the leaves of which are rich in carbohydrates, and by use of appropriate fertilizers, to increase considerably the resistance of coffee trees to cold.

Horizontal geotropism, H. COUPIN (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 10, pp. 608-610).—In certain cultivated legumes a horizontal geotropism was noted as present when the plant was kept in darkness.

Nonsymbiotic germination of orchid seeds, L. KNUDSON (*Bot. Gaz.*, 73 (1922), No. 1, pp. 1-25, figs. 3).—A method is given for sterilizing seeds of certain orchids and for growing them under sterile conditions.

Germination of seeds of *Laelia*, *Cattleya*, and related forms is possible without the aid of any fungus when certain sugars are supplied. Fructose appears more favorable than glucose. In the presence of glucose, chlorosis of the embryo generally develops. Germination is possible on certain plant extracts containing traces only of sugar, and embryos in such cultures accumulate a considerable reserve of starch. The concentration of glucose is important in the growth of the embryo. *Bacillus radicola* from alfalfa and certain other microorganisms on certain media show a favorable influence on the development of chlorophyll and germination. Seedlings have been transplanted from tubes to large flasks and growth has continued, the results thus far obtained indicating that the method is of value in the propagation of orchids from seeds.

It is held that the necessity of fungus infection for germination has not yet been proved, one cause of failure of germination being, possibly, the pathogenic character of some of the endophytic fungi.

FIELD CROPS.

The work [with field crops] of the Yuma Reclamation Project Experiment Farm in 1919 and 1920, E. C. NOBLE (*U. S. Dept. Agr., Dept. Circ.* 221 (1922), pp. 15-28, figs. 5).—The continuation of previous work (*E. S. R.*, 43, p. 329) is reported on.

Toole, Dixie, Yuma, Sproull, and Rowden, with respective average acre yields, 2,450, 2,310, 2,200, 2,142, and 2,098 lbs. of seed cotton were first among cotton varieties compared from 1916 to 1920, inclusive. Selection and improvement work was carried on with the extra-staple varieties, Durango, Tuxtla, and Kekchi. The results from the furrow-and-bed method of planting (*E. S. R.*, 39, p. 433) have not been such as to recommend it for general usage instead of the ordinary method. Plats treated with acid phosphate yielded slightly higher than those receiving sodium nitrate or potassium sulphate. Where two rows of cotton were alternated with one row of cowpeas the increased yield of the cotton rows did not compensate the loss of the third row.

Hairy Peruvian, smooth Peruvian, India, Arizona common, Kansas common, Turkestan, Grimm, and Baltic alfalfa varieties ranked in about the order named in acre yields and adaptability. The Peruvian types have been foremost in vigor and total yields since 1915, the hairy-leaved strain comprising about 70 per cent of the alfalfa acreage on the project. Preliminary fertilizer tests indicate increased hay yields from 10 tons of barnyard manure or from 300 to 400 lbs. per acre of acid phosphate.

Foremost in varietal comparisons were Dwarf milo, Dwarf hegari, and feterita grain sorghums; Gooseneck, White-African, Honey, Java, Collier,

and Sumac sorghos; Mariout and Smyrna barley; Sonora and Baart wheat; Lineta and selections from Nova Rossisk and La Plata flax; and Amraoti and Bangalia field peas for seed and Scotch Blue and Liberty field peas for green manure.

Broadcasting was usually found better than planting flaxseed in rows from 18 to 30 in. apart, except on a heavy soil which formed crusts around the stems.

Although, with the exception of alfalfa, legumes are of little value as forage crops in the region they have promise as green manure. Vetches as a class were inferior to field peas for all purposes. While sweet clover, sour clover, bur clover, and berseem are of favor as green manure crops, the danger of volunteer plants mixing with other seed crops limits their extensive use.

[**Report of plant breeding work in Michigan**], F. A. SPRAGG (*Michigan Sta. Rpt. 1921, pp. 191-195*).—Variety tests with barley and notes on breeding work with alfalfa, barley, beans, red clover, corn, hemp, Hubam sweet clover, oats, potatoes, rye, sugar beets, and wheat are summarized.

[**Report of field crops work at the Dickinson Substation in 1920 and 1921**], L. MOOMAW (*North Dakota Sta. Bul. 160 (1922), pp. 2-25, 26-29, figs. 4*).—The continuation of experiments with field crops during the years indicated is described as heretofore (*E. S. R.*, 44, p. 30). The leaders in varietal tests with cereals and potatoes and the 12-year average acre yields of wheat and oats under various cultural treatments have been noted (*E. S. R.*, 48, p. 30). Other varieties outstanding include Bangalia and McAdoo field peas. Turkestan millet, and Black Voronezh proso. Mangels made the maximum yield among root crops in 1920, rutabagas in 1921.

The results of 15 years' experiments with crop rotations and tillage methods show the desirability of crop rotation, since the yields of wheat and oats in rotation were much greater than those on continuous cropped spring plowing. Very little difference was noted between spring and fall plowing. Disked corn ground seems to be the most economical preparation for wheat, oats, or barley. Plowing under of green manures has not given profitable increases in the grain crop following immediately. Manuring the land before corn increased the yield of fodder about 25 per cent and increased the grain yield slightly. Indications are that the best practice for corn production is planting on spring plowed grain stubble. The use of sod crops in short rotation is not considered practicable as the yields of small grains after either brome or alfalfa were less than in other rotations omitting sod crops.

Dakota common alfalfa and Grimm in 3.5-ft. rows averaged considerably more hay per acre than when broadcasted. White-flowered biennial sweet clover in rows made 2,088 lbs. of hay per acre and the yellow flowered 1,667 lbs., but in broadcasted stands the yellow species greatly outyielded the white. Although white annual sweet clover produced more than first year white biennial, the annual is not thought desirable for hay, its chief value in the section being for seed as long as the price remains relatively high. Sweet clover seeded alone produced nearly as much hay as that seeded with nurse crops of wheat, oats, barley, or flax.

Brome grass gave heavier hay yields in rows, while slender wheat and crested wheat grasses made more hay when broadcasted. All produced more seed on broadcasted plats.

Early Ohio potatoes treated with formalin solution before and after cutting produced, respectively, 6.7 and 5 bu. more per acre than untreated stock, which made 37.5 bu.

[**Report of field crops work at Williston Substation, 1914-1920**], C. H. RUZICKA (*North Dakota Sta. Bul. 158 (1922), pp. 14-65, 99, 100, figs. 2*).—

The progress of earlier work (E. S. R., 29, p. 424; 35, p. 229) is reported, and important findings are summarized.

Kubanka, Power, and Marquis were the best wheat varieties, with the durums slightly outyielding the hard wheats. Acme, Monad, and D-5 outyielded all other varieties in the three years grown. Durums did not excel in resistance to drought or heat injury, but withstood rust better than common wheats. The bluestems yielded less than the durums and fifes and averaged lower in quality. Winter wheats were not satisfactory, winterkilling severely even when seeded in standing stubble and corn. Mid-season oats were superior to both early and late varieties, with Abundance, Lincoln, Silvermine, and Early Mountain giving the best results. Two-rowed barleys averaged higher than 6-rowed varieties, with Hannchen leading. North Dakota No. 155 and Resistant No. 114 flaxes gave the most satisfactory averages. Spring rye was inferior to winter rye, and emmer produced less feed than either oats or barley.

Earlier seeding was preferred to later seeding for all cereals. About May 1 gave the best results with flax, which was not perceptibly injured by late frosts when seeded early. The best acre rates of seeding seemed to be 1 bu. for wheat, 5 pk. for durum, 6 to 8 pk. for oats, 4 to 6 pk. for barley, and 2 pk. for flax.

While proso and the millets returned fair seed yields, little promise was shown by field peas for seed, chick-peas, soy beans, hemp, buckwheat, and the grain sorghums.

Northwestern Dent corn proved the best variety for general crop and Gehu and Dakota White Flint for grain yields. Moisture is said to be a greater limiting factor than length of season with acclimated corn. May 8 to 22 proved the best average time of planting. Fall plowing was superior to spring plowing for corn, but listing gave no particular advantage. Manuring for corn was warranted by increased yields, whereas green manuring was without results. Corn after wheat yielded better than after the other small grains, and gave larger yields in short rotations than in long rotations. Glazed and mature corn had the highest dry weight per acre and these stages are deemed most suitable for feed. Lambs and hogs were fed profitably on standing corn. Sunflowers yielded similarly to corn for silage.

Early potatoes were better than late varieties, which seldom matured fully. Early Eureka and others of the Cobbler group yielded highest, the group averaging 135 bu. per acre. Green Mountain, the leading late variety, yielded slightly under the Cobblers, but is not recommended in their stead for commercial growing. Superior yielding strains were noted within Early Ohio and Triumph varieties. One eye or about a 1-oz. seed piece was the most desirable for planting, and large whole potatoes (6 oz.) gave the largest gross yield with the most culls. From 12 to 18 in. apart in rows 3 ft. apart was found the best spacing, and 3 to 4 in. the best depth. Mulching with straw was greatly inferior to cultivation, machine-cut potatoes yielded less than hand-cut seed, and seed from high-producing hills yielded about 18 per cent more marketable tubers than bin-selected seed. Yield differences between hand and machine plantings were small. Irrigated seed made slightly less than dry land seed. Early hilling is considered a detrimental cultural practice, but is said to be beneficial in the fall for protecting tubers near the surface from sunburn and frost.

Negative results with alfalfa in rows without irrigation in four dry years are explained as being due largely to unfavorable locations. Yellow flowered sweet clover produced a finer hay than the white variety, although much coarser and harder to cure than alfalfa. The averages for two years showed

a carrying capacity of sweet clover of an equivalent of 10 sheep per acre for 116.5 days, practically the growing season. Little difference was observed in the yields from millet varieties. Proso averaged the tallest growth in dry years, but makes a coarser and a less palatable hay than the common or foxtall varieties.

Peas and oats for hay gave suitable yields only in rather cool seasons with favorable moisture. Peas alone made somewhat less than with oats and with a poorer resulting hay. The Canada yellow pea gave the highest yields. Four pecks of oats seeded with from 4 to 8 pk. of peas per acre gave about the same yields as when more oats were used.

Cows found Russian thistle hay palatable though somewhat laxative, and refused only the thicker stems. Sheep thrived on thistle pasture in spite of the very laxative effect particularly when green and succulent. Brome grass greatly exceeded slender wheat grass in quality and quantity of pasture and led in hay yield. Timothy, red clover, vetch, chick-peas, soy beans, and rape were tried without much success.

An average yield of 15.6 tons of beets with 17 per cent sugar indicated the commercial possibilities of sugar-beet culture, with suitable marketing facilities. Klein Wanzleben and Vilmorin Elite were the best varieties tested.

Crop rotation and tillage methods, C. H. RUZICKA (*North Dakota Sta. Bul. 158 (1922), pp. 65-83, figs. 2*).—Experiments in crop rotations and tillage methods, in cooperation with the Office of Dry Land Agriculture, U. S. D. A., since 1909 gave evidence that crops in a rotation including corn or a cultivated crop are more economical than continuous or haphazard cropping. Grains on fallow do not give large enough returns over yields after corn to warrant fallow except as an emergency or temporary measure. Alternating fallow and small grain in successive years had little advantage and was uneconomical. Small grains after small grains of a different kind have given satisfactory yields in the rotations. Yields in the shorter rotations were larger than in the 5 and 6 year rotations.

Very little difference was apparent between fall and spring plowing. Disking corn stubble for small grains equaled plowing and was more economical. Green manuring with rye, peas, or sweet clover did not affect yields and greatly increased the cost of production. Cultivated grasses gave unsatisfactory yields, without beneficial effect on crops following in the rotation. Depth of plowing for wheat did not seem to be an important factor in the section. Stubbling-in gave very low yields. The absence of a water table in the soil makes imperative the major dependence of the crop on precipitation of the same year. Cultivation for a mulch had little effect, whereas cultivation to eliminate weed growth is necessary to successful crop production.

Flax averaging 7.3 bu. per acre for six years had no greater cash value than wheat averaging 14.8 bu. In dry years, when Russian thistle seriously menaces the flax crop, wheat proved the surer, producing over three times as much as flax. Flax did not effect injury upon the crop following. Corn ground proved practically equal to fallow as preparation for both flax and wheat, whereas fallow was not economical. Sweet clover as green manure did not affect the yields of the crops in the same rotation, although it was of fair value as hay. A suggested rotation with flax, based on the results reported, includes corn, followed by flax as a nurse crop for sweet clover, sweet clover for hay, and wheat on sweet-clover sod. The limited success obtained does not warrant extensive flax culture.

[**Field crops work in Porto Rico in 1921**], T. B. McCLELLAND, T. BEEGER, W. P. SNYDER, and J. A. SALDAÑA (*Porto Rico Sta. Rpt. 1921, pp. 10, 11, 14-18*).—*Crotalaria juncea* produced the highest dry weight of the various

cover crops tested, and its rapid growth enabled it to hold its own against encroaching weeds better than *C. striata* and *Tephrosia candida*.

Key West and Pierson led the sweet potato varieties in yield; Dahomey and Porto Rico produced the largest tubers and Early Carolina the smallest tubers; and Nancy Hall, Mamey, and Florida were considered of superior table quality.

Staked yams yielded over 385 lbs. and unstaked plants 67 lbs., the greatest difference being noted in the Potato variety. The unstaked plants produced no large tubers, and most of the other tubers produced were too small to be marketed.

Breeding work with corn, rice, soy beans, cowpeas, kidney beans, vanilla, and forage grasses is briefly reviewed, and limited trials with varieties of corn, sweet corn, and wheat are described.

Five-gal. oil cans fitted with milk-can lids proved useful in keeping seed viable over periods of unfavorable weather. Fresh unslaked lime is put in the containers with the seed, and the cans are then sealed with paraffin.

Seedlings of sugar-cane varieties D. 109 and Java 36 averaged higher in resistance to the mottling disease than did seedlings of other varieties tested. The influence of the habit of growth of the parent varieties was very evident in the large number of erect-growing seedlings obtained from P. R. 260.

Results of experiments [with field crops] at Fort Vermilion, Alta., R. JONES (*Canada Expt. Farms Bul. 6, n. ser. (1922), pp. 7-9, 13-24, figs. 4*).—Outstanding varieties with their characteristics are indicated from results of variety trials from 1908 to 1921, inclusive, with wheat, oats, barley, field peas, miscellaneous cereals, potatoes, swedes, turnips, mangels, carrots, sugar beets, sunflowers, silage corn, and miscellaneous grasses and legumes.

[**The Woburn field experiments, 1921**], J. A. VOELCKER (*Jour. Roy. Agr. Soc. England, 82 (1921), pp. 276-283, 284-286; also in Woburn Expt. Sta. Rpt. 1921, pp. 1-10, 11-13*).—Experiments with field crops are reported in continuation of previous work (E. S. R., 46, p. 435). The season of 1920-21 was characterized by an exceptionally dry summer.

The highest grain yields in the continuous wheat experiments were 33.5 bu. with 3,236 lbs. of straw from the plat receiving farmyard manure, and 24.9 bu. and 2,244 lbs. of straw from the plat receiving mineral manures with nitrate of soda in alternate years. The untreated checks averaged 8 bu. of grain and 659 lbs. of straw. Mineral manures alone returned 8.9 bu. of grain and 774 lbs. of straw. Nitrate of soda was somewhat superior to sulphate of ammonia. Rape dust produced only 13 bu. of grain and 1,176 lbs. of straw. "As has been shown on these plats, it is in a dry season that farmyard manure, mainly by its power of retaining moisture in the land, proves far superior to any other dressing or any combination of artificial manures, even when lime be added."

The barley crop was very poor, suffering greatly from drought. Farmyard manure again produced the maximum yield on the continuous barley plats, 20.6 bu. of grain and 1,492 lbs. of straw, and was followed by a plat receiving mineral manures and nitrate of soda in alternate years, with 12.9 bu. of grain and 994 lbs. of straw. The untreated plats averaged 5.7 bu. of grain and 501 lbs. of straw per acre. Mineral manures alone gave 9.1 bu., and 11 bu. where lime had been added in 1915. As in the continuous wheat experiments, nitrate of soda was superior to sulphate of ammonia.

On rotation plats, where the effects of unexhausted residues from cake and grain feeding were compared, wheat and red clover produced 37.4 bu. of grain on the grain plat and 31.2 bu. on the cake-fed plat. The wheat grown in this rotation yielded 4 bu. per acre more than that on the highest plat in the continuous wheat series.

In improvement work with old pastures, farmyard manure gave the heaviest yield, 3,632 lbs., and was followed in effectiveness by applications of basic slag with kainit and with sulphate of potash. In a comparison of various kinds of lime for grassland, Buxton lime with 2,604 lbs. of hay exceeded the yield of the untreated check by 532 lbs. Ground lime and ground chalk again showed their superiority in tests of different forms of lime. Yields from a plat alternately cut for hay and grazed were only slightly larger than from a plat continuously cut for hay.

[Report of field crops work in Northumberland County, England], D. A. GILCHRIST (*County Northumb. Ed. Com. Bul. 34* (1922), pp. 8-52).—Rotation, fertilizer, and variety trials with various field crops are described in continuation of previous work (E. S. R., 46, p. 726).

[Field crops work in Aberdeen, Scotland] (*North of Scot. Col. Agr., Guide Expts. Craibstone, 1922*, pp. 7-31, 33, 34).—The progress of experiments with field crops (E. S. R., 46, p. 227) at Craibstone farm near Aberdeen is reported for 1921.

Leguminous crops for Guam, G. BRIGGS (*Guam Sta. Bul. 4* (1922), pp. 11+29, pls. 14).—Based on the results of seeding, cultural, and varietal trials at the station (E. S. R., 46, p. 725), information is given concerning the uses and feeding value of legumes, their adaptation to Guam, cultural and harvesting methods, seed storage, and the choice of a legume for a particular situation. Comment is made on the behavior of varieties of the cowpea, velvet bean, soy bean, peanut, and alfalfa, and on the pigeon pea, jack bean, mungo bean, patani bean, and miscellaneous small bean varieties. Notes are included on the bonavist, seguidilla (*Psophocarpus tetragonoloba*), fijole (*Vigna sinensis*), tañgantañgan (*Leucaena glauca*), camachile (*Pithecolobium dulce*), aromo (*Acacia farnesiana*), yam bean (*Pachyrhizus tuberosus*), creeping tick trefoil (*Desmodium triflorum*, *D. heterophyllum*), algaroba (*Prosopis juliflora*), bur clover, and kudzu.

Trebi barley, a superior variety for irrigated land, H. V. HARLAN, M. N. POPE, and L. C. AICHER (*U. S. Dept. Agr., Dept. Circ. 208* (1922), pp. 8, figs. 2).—Trebi, a new variety of barley described in this circular, originated from a single plant from seed imported from Samsun, Asiatic Turkey, on the southern border of the Black Sea. The data recorded show it to be specially adapted to irrigated conditions in southern Idaho, and a large proportion of the barley crop of the irrigated districts adjacent to Aberdeen now consists of this variety. Trebi is recommended for irrigated lands where the summer season is similar to that in southern Idaho. While Trebi has given good yields and appears promising in some sections without irrigation, it has not been tested long enough to determine its worth under these conditions.

Linkage between brachysm and adherence in maize, J. H. KEMPTON (*Amer. Nat. 56* (1922), No. 646, pp. 461-464).—Further studies of brachysm and adherence in corn (E. S. R., 44, p. 734) gave indications that the genes for these characters are located on the same chromosome.

Cotton experiments, 1921, [at] Delta Branch Station, W. E. AYRES (*Mississippi Sta. Circ. 42* (1921), pp. 8, figs. 2).—Cultural, variety, and breeding work with cotton (E. S. R., 45, p. 130) was continued in 1921.

Although Express led the important Delta varieties from 1912 to 1921, inclusive, Delfos (Delta-bred Foster) has produced highest during recent years. Webber, the third variety, is considered of value except on very fertile soil and on cold and late land. Delfos strains, Sunpress, Deltatype Webber, and Express 432-782 led the 1921 trials of standard varieties. These varieties averaged 74 per cent more in acre value than the poorest five varieties. The merits

of Delfos 6102 and Sunpress (Sunflower×Express), outstanding in the final test of Delta-bred strains for commercial value, have already been noted (E. S. R., 47, p. 227).

Eight-inch spacing made the most seed cotton per acre both in 1921 and in a three-year period. Express cotton topped 50 and 60 days after planting produced 233 and 93 lbs., respectively, less seed cotton than plants not topped.

The uniformity of Pima cotton, T. H. KEARNEY (*U. S. Dept. Agr., Dept. Circ. 247 (1922), pp. 6*).—Methods used in the Salt River Valley of Arizona in conserving the uniformity and in providing pure planting seed of Pima long-staple cotton are described, the causes of deterioration of cotton varieties are pointed out, and a summary of methods for providing good planting seed is given. Pima belongs to the Egyptian type of cotton, with fiber averaging $1\frac{1}{8}$ to $1\frac{1}{4}$ in. in length, and has been found to be adapted only to the hot irrigated valleys of Arizona and southern California. It is said that numerous trials have shown it to be unsuited to conditions in the main Cotton Belt.

Pure seed for planting the annual crop in the Salt River Valley is provided by roguing a limited acreage and by increasing during the following year the seed from the rogued field under such conditions as to prevent contamination. Precaution is taken to avoid mixture with other cottonseed at the gin. Results of roguing operations, in cooperation with the University of Arizona, showed no degeneration or loss of uniformity, and experimental evidence cited indicates that this system has for all practical purposes maintained the characteristics and the uniformity of the variety as successfully as the method of line breeding used at Sacaton. The uniformity of the variety is so great that complaints of some bales of mixed quality, containing cotton differing both in grade and staple, are explainable as due to variation in cultural methods or soils.

The extension of cotton cultivation in Tanganyika Territory, H. HORNE (*London: Empire Cotton Growing Corporation, 1922, pp. 48, pl. 1, figs. 20*).—This report comprises descriptions of the geographical and political conditions in the country, criticisms and recommendations concerning the development of the cotton industry, and a discussion of the imperial aspects of cotton growing. Notes on cotton culture and experiments during the German occupation and diagrams showing the annual rainfall distribution at important centers are appended.

[**A historical review of oats culture**], S. HASUND (*Nord. Jordbrugsforsk., 1922, No. 3-4, pp. 297-306*).—This article discusses the culture and uses of oats in Scandinavian countries during the age of the Sagas, and points out the relative importance of oats, barley, and other cereal crops in that period.

Potato handbook for North Dakota potato growers, H. L. BOLLEY ET AL. (*N. Dak. Agr. Col. Ext. Circ. 50 (1922), pp. 64, figs. 28*).—A circular of information discussing varieties, cultural methods, control of insects and diseases, the seed plot, storage, marketing, and certification.

Potato varieties, UHRMANN (*Graser's Naturw. u. Landw. Tafeln No. 19, chart 1*).—Specimens of 33 leading German potato varieties are illustrated in color on this chart, with the season, uses, and skin color indicated for each.

Winter storage of potatoes, E. SCHAFFNIT (*Arb. Kartoffelbaugesell., No. 22 (1920), pp. 23, figs. 12*).—Descriptions of storage methods are given with instructions for varying conditions.

Rice investigations, L. G. WILLIS and J. O. CARREBO (*Porto Rico Sta. Rpt. 1921, pp. 7, 8*).—Contrary to findings of other investigators, the authors found that rice does not differ physiologically from most crop plants in its response to fertilization with nitrogen in the form of nitrates. Where other factors do

not influence the growth of the plant, the use of nitrate fertilizers gave results as good or even better than those from ammonium sulphate. The conclusion was reached that nitrate nitrogen, or any of the nitrogen products into which it may be converted in the soil, is neither toxic nor incompatible to the rice plant. In general practice, however, the continued use of ammonium sulphate is considered advisable because of the liability of nitrates to loss from leaching or denitrification when used under conditions peculiar to rice culture. The fertilizer tests in the field were very contradictory, but the average was definitely in favor of ammonium sulphate on a sandy soil, alkaline with carbonate of lime, compared with any form of nitrate used.

Researches into rice cultivation [K. V. JOSHI] (*Bombay Dept. Agr. Ann. Rpt., 1919-20, pp. 76, 77; 1920-21, pp. 72, 73*).—Studies on the life history of the rice plant and its response to external treatment are described.

The observations indicated that the limits of age between which seedlings can be transplanted for maximum yields are fairly wide, 16 to 40 days during the year 1920-21, and can be extended by about a week by thinner sowing of the seed bed. A study of the situation and histology of the growing point did not help to determine and define the right stage. Extra vigor in seedlings as obtained by better fertilizer treatment did not confer a material advantage. A decrease in the number of seedlings per bunch to be transplanted was not made up by tillering or increased size of panicles, indicating that a reduction in the number of seedlings must be accompanied by reduced spacing. This ratio did not follow arithmetical progression. Ammonium sulphate and superphosphate were of some benefit to the rice crop, but the maximum increases obtained were not profitable. Increasing the number of plowings in preparing a puddle for transplanting resulted in small yield increases up to nine plowings. Dry seed sown directly into the field in hills of five or six seeds regularly spaced yielded equal to or somewhat higher than the transplanted crop. From this it might be inferred that the principle underlying transplanting seems to be more for adjustment with environmental and economic requirements than for any physiological advantages.

United States grades for rye, H. J. BESLEY, E. G. BOERNER, and J. H. COX (*U. S. Dept. Agr., Dept. Circ. 246 (1922), pp. 6*).—Grades recommended by the U. S. Department of Agriculture for the grading and marketing of rye are outlined.

The sorghums in Guam, G. BRIGGS (*Guam Sta. Bul. 3 (1922), pp. 11+28, pls. 9*).—Descriptions of varieties of grain and sweet sorghums and their behavior under Guam conditions are presented, together with information on growth conditions of the crop, cultural methods, ratooning, selection and storage of seed, feeding value, diseases, and insect pests, based on seeding, cultural, and varietal trials (*E. S. R., 46, p. 725*), and other tests at the station.

Both grain and sweet sorghums have been successfully grown on Guam for more than 15 years. The sorghums are especially suited to Guam conditions because they are drought resistant, supplying forage during the dry season when other forage crops make poor growth, and are little subject to diseases or insect attack. The highest grain yields were made by Blackhull kafir, Dwarf hegari, Dawn kafir, and feterita, and the highest forage yields of the nonsaccharin sorghums were made by Dwarf hegari, white milo, Schrock kafir, and yellow milo. Red Amber and Black Amber made the highest grain and forage yields of the sweet sorghums.

Nitrogenous fertilizers for sugar cane in Java, J. KUYPER (*Arch. Suiker-indus. Nederland, Indië, 1922, No. 3, pp. 145-154, figs. 6*).—Various nitrogenous materials were compared with ammonium sulphate as sources of nitrogen for

sugar cane on plantations in Java. See also a note by Geerts (E. S. R., 45, p. 739).

Although sodium nitrate, ammonium sulphate-nitrate, and ureum nearly equaled ammonium sulphate, they were considered rather hygroscopic for tropical conditions. While the residue of oil extraction from peanuts was not as good as ammonium sulphate, it gave better results mixed with ammonium sulphate than when applied alone, and proved better on light than on heavy soils.

Tobacco selections in Sumatra in 1921, S. C. J. JOCHEMS (*Meded. Deli Proefsta. Medan*, 2. ser., No. 23 (1922), pp. 25).—The results of trials of various selections of Deli tobacco are reported for the year 1921, in continuation of earlier work (E. S. R., 45, p. 740).

Growing and handling of tobacco in the Netherlands East Indies, N. VAN AKEN (*Tobacco*, 74 (1922), No. 18, pp. 20-23, 25, 27, 29, 31, figs. 11).—This article indicates the principal varieties cultivated, and outlines cultural, curing, and market practices employed in the production of tobacco in the Dutch East Indies.

The nicotin content of South African tobacco, C. F. JURITZ (*So. African Jour. Indus.*, 5 (1922), No. 8, pp. 347-356).—Analyses of samples from different parts of the Union of South Africa showed that the heavier tobaccos contained from 3 to 5 per cent of nicotin, whereas the lighter South African leaf did not contain much over 2 and often less than 1 per cent. The leaves of the common wild tobacco, *Nicotiana glauca*, contained much less than 1 per cent. *N. rustica* gave over 6 to 8 per cent of nicotin.

Nicotin is found in all parts of the plants but mainly in the leaves. Tests with *N. rustica* at Elsenburg suggest that the leaves of young transplants contain under 1 per cent, increasing to about 2 per cent 6 weeks after transplanting, to nearly 3 per cent when 2 months old, and attaining 6 to 8 per cent in the mature plant.

The velvet bean, C. V. PIPER and W. J. MORSE (*U. S. Dept. Agr., Farmers' Bul.* 1276 (1922), pp. 11+27, figs. 14).—This is a revision and extension of Farmers' Bulletin 962 (E. S. R., 39, pp. 538, 575), including the sections on feeding value of velvet beans.

The hard red winter wheats, J. A. CLARK and J. H. MARTIN (*U. S. Dept. Agr., Farmers' Bul.* 1280 (1922), pp. 11+10, figs. 2).—The characteristics and adaptations of hard red winter wheat varieties are described on the basis of extensive experiments and surveys by the Department and State experiment stations.

Although the culture of hard red winter wheats is largely confined to Kansas, Nebraska, and Oklahoma, they are grown to some extent in adjacent and near-by States, and small acreages are found in more distant parts of the country. Hard red winter wheats occupy nearly one-third of the total wheat acreage in the United States. The 12 varieties grown in the country are known under about 40 names. Turkey, Kharkof, and Kanred (E. S. R., 46, p. 136) are the leaders, but even Turkey and Kharkof are practically identical and until the recent distribution of Kanred made up nearly all of the hard winter wheat acreage. Several nearly identical pure lines of Turkey or Kharkof have outyielded the ordinary varieties in the States in which they were developed. Other high yielding varieties of local significance include Blackhull in Kansas, Minturki in Minnesota, and Bacska in Wisconsin.

The hard red spring wheats, J. A. CLARK and J. H. MARTIN (*U. S. Dept. Agr., Farmers' Bul.* 1281 (1922), pp. 28, figs. 11).—The 24 distinct varieties of hard red spring wheat grown commercially in the United States are described,

and their adaptations, cultural value, and milling and baking qualities are indicated. This class of wheat comprises about one-fourth of the total wheat acreage of the United States, being grown principally in the north-central portion of the country where winters are too severe for winter wheat. The behavior of the principal varieties in this class has been detailed in an earlier note (E. S. R., 44, p. 141).

Early Baart wheat. W. E. BRYAN and C. J. WOOD (*Arizona Sta., Timely Hints for Farmers*, No. 141 (1922), pp. 7, figs. 2).—The distinguishing qualities of Early Baart wheat are described, with notes on the baking qualities of its flour and cultural and irrigation methods. Early Baart is a bearded variety with white glumes and semihard grains. Besides yielding equal to any variety tried at the station, Early Baart is said to be the best milling wheat, producing the best baking flour of the Arizona-grown wheats tested.

The mechanical resistance to lodging of some pure varieties of wheat. A. DRAGHETTI (*Stat. Sper. Agr. Ital.*, 54 (1921), No. 4-6, pp. 145-180, fig. 1).—Studies were made to determine the mechanical resistance to lodging of a number of wheat varieties, and to investigate and evaluate characters for guides in selection. Biometric data were secured, the weights required to bend internodes to breaking points, angles of deflection, etc., being calculated on apparatus similar to that of Kirsche (E. S. R., 16, p. 41).

A positive correlation was observed between the unit weight of the internode and its resistance to bending. The average elasticity of the internodes was found to be correlated perfectly with the degree of lodging observed in the plants. When the first internode bent from 4.8 to 5.9 cm. (1.9 to 2.3 in.), completely upright culms were noted; the culms were partly lodged when the internode bent from 7.3 to 8 cm.; and with bending from 8.8 to 9 cm., the culms were completely lodged.

The author found that the dominant deforming force, the wind, has a coefficient of influence varying from 64.3 to 83.7 per cent of the total deflection and inversely proportional to the flexibility of the culm. However, the only relation considered as having an absolute and specific value is that resulting from the comparison of the index numbers of the moments of resistance and of total deflection. Indexes of resistance to lodging obtained by this comparison were as follows: Rieti No. 11 1.026, Gentil rosso No. 48 1.002, Cologna No. 12 0.881, Inallettibile No. 38 1.232, Carosello No. 91 1.052, Masolina No. 33 0.981, Cororation 1.309, Apulia 0.818, Luigia Strampelli 0.950, and Dauno, 0.877.

The static relation of the culm is given by the formula:

$$\pm M = \frac{KI}{z} \geq \left(0.57 \frac{A+a}{2} p \cdot h \right) + \left[(P+P_1) h_1 \tan \alpha \right]$$

where K indicates the unit force of the most important elements of the section of the culm, $\frac{I}{z}$ the moment of the resistance of the circular corona (I=moment of inertia, z=distance of deformation of an external fiber from a neutral plane), A and a the areas of the culm and spike respectively, subject to wind force, p the unit pressure of the wind, h the height of the vertical projection of the culm, P the weight of the culm, P₁ the increase in weight of the culm due to rain water, h₁ the height of the center of gravity, and α the angle of the new direction of the culm with its original position. In this relation, the values K, $\frac{I}{z}$, and h represent particular characteristics of the race, qualities on which depend the degree of mechanical resistance to lodging of the various types of wheat.

The critical period of wheat with respect to rain, G. AZZI (*Nuovi Ann. [Italy] Min. Agr.*, 1 (1921), No. 2, pp. 299-307).—Irrigation studies with 4 varieties of wheat are said to have confirmed the existence of a critical period, 30 days before and 6 days after the exertion of the spike. Length of straw and all other characters correlated therewith increased in value, with accretion of water available to the plant during the critical period. Cervaro and Apulia showed the most drought resistance and spelt and Carlotta Strampelli the least. The effective productivity of a plant is held due to a balance between specific productivity and resistance to harmful atmospheric phenomena.

Wheat and flour equivalent tables, A. BRIDGES (*Chesterfield, Eng.: [Author], rev. and enl. ed.*, pp. [13]).—Tables designed for the British flour-milling trade.

Milling and baking data 1921 wheat crop on demonstration farms, E. I. OLSEN (*North Dakota Sta. Bul.* 163 [1922], p. 52).—Milling and baking data are tabulated for samples of Marquis, Kota, and Power hard red spring wheats, and on Kubanka, Monad, Acme, Arnautka, and common durum wheats from the 1921 crop.

Report of analyses of samples of seed collected in New York State (*N. Y. State Dept. Farms and Markets, Agr. Bul.* 142 (1922), pp. 32).—The results of analyses by the New York State Experiment Station of 383 official samples of agricultural seeds collected during 1921 are tabulated.

A potential weed: *Araujia sericifera*, E. P. PHILLIPS (*Union So. Africa Dept. Agr. Jour.*, 5 (1922), No. 2, pp. 151, 152, fig. 1).—*A. sericifera* is indicated as a possible nuisance in plantations and in gardens.

Wild garlic eradication, A. A. HANSEN (*Purdue Agr. Ext. Bul.* 111 (1922), pp. 8, figs. 5).—The habits of wild garlic are described, eradication methods outlined, and a method of removing the garlic flavor from milk is offered. Wild garlic can be destroyed by a system of cultivation consisting essentially of deep fall plowing in such manner as to turn the garlic tips completely under, followed by early spring plowing and planting to such cultivated crops as corn or soy beans in rows. This method must be followed for at least three years.

HORTICULTURE.

Hardiness from the horticultural point of view, M. J. DORSEY (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 173-178).—Peculiar results were obtained at the Minnesota Fruit Breeding Farm in a study of wild red raspberry (*Rubus strigosus*) seedlings, raised from seed collected in the summer of 1916 in widely scattered regions of Manitoba. The sharp differences in habit of growth of the seven lots are illustrated in tabular form, in which is shown a range of from 44 to 60 in. in height and 36 to 72 in. in spread of row. Differences were also recorded in the comparative hardiness of the several lots in the winter of 1919-20. In the following winter all lots were frozen to the ground, indicating that, though grown in a region far south of their native habitat, the plants were lacking in hardiness. A careful study of the botanical characters of the raspberry seedlings showed many variations in respect to smoothness of canes, color of spines, color and size of berries, etc.

Of three lots of red oak seedlings grown from seed obtained in Pennsylvania, St. Paul, Minn., and Itaska Park, Minn., only the Itaska Park lot was able to survive the first winter unharmed.

Citing the Concord grape as an example, the author points out that a variety may surpass its parent species in hardiness and in adaptability to various types of soil.

Many factors, including nutrition, protection, time of maturity, and rest period, are related to hardiness. Parts of an individual plant may successfully survive freezing injury, while the remainder is killed, as shown in *Prunus* (*Amygdalus*) *daurica*, wherein the wood and cambium are able to survive the winters at the Minnesota Experiment Station, while the fruit buds are always killed. Apple seedlings are often killed by the death of the roots, while the top is uninjured. Even in the individual fruit bud the scales may be uninjured while the other parts are killed.

Observations on hardiness in the colder parts of Canada, W. T. MACOUN (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 160-165).—A summary of information relative to the behavior in respect to freezing injury of various species of plants at Ottawa and other Canadian locations.

Records taken following the severe winter of 1917-18 on the amount of injury to 300 varieties of apples grown in the Central Experiment Farm nursery at Ottawa showed only 10.97 per cent uninjured, and of these 60 per cent were hybrids between crab and standard apples. It is believed that the relative hardiness between varieties of a single species like the apple is correlated with the tendency to drop leaves early in the fall. Evidence of correlation between early maturity of fruit and hardiness of tree was noted in the spring of 1904 following the winterkilling of 164 varieties, 79 per cent of which were classified as early winter or winter kinds.

Experience having shown that in many plants the roots are more tender than the limbs, it is recommended that such species be worked on hardy stocks. The use of crab apples as stocks at Ottawa has prevented severe losses from winter injury. The function of snow in assisting in winter protection is emphasized. In conclusion, the author points out that a multiplicity of factors, such as moisture content of plant and of soil, concentration of sap, rapidity of freezing and thawing, etc., are involved in the hardiness problem.

Relationship of water-retaining capacity to hardiness, J. T. ROSA, JR. (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 166-169).—The material here presented has been noted for the greater part from another source (*E. S. R.*, 46, p. 827).

[Horticultural investigations at the Porto Rico Station, 1921], T. B. MCCLELLAND, W. P. SNYDER, and J. A. SALDAÑA (*Porto Rico Sta. Rpt. 1921*, pp. 10, 11-14, 19-22, pl. 1).—The experimental activities of the year were similar to those previously reported (*E. S. R.*, 45, p. 638).

A test with garden bean varieties completed during the year demonstrated the superiority of varieties native to the Caribbean region over those imported from the States. Of the natives, the black and the white beans were found most productive. Of the introduced northern varieties, Extra Early Valentine, Fordhook Favorite, and Robust excelled.

The leaves of *Talinum verticillatum*, a plant recently introduced from Java via the Philippine Islands, showed promise of value for use as a spinach. Observations upon the time required to cure vanilla beans showed that, while most of the beans in a given lot dry within a brief period, from 10 to 16 weeks are required to complete the operation. Wounding or "needling" vanilla pods hastened drying but detracted from the appearance of the product and decreased the keeping quality.

The semiannual application of nitrate of soda to coffee plants, carried on over a period of five years, failed to increase the yield. The use of sulphate of ammonia, on the other hand, proved much more effective, increasing the yield four times that of the nitrate of soda plot. In a fertilizer test with

coconuts, the largest yield was obtained on the plat to which common salt, sodium chlorid, was applied alone.

The girdling of the limbs of 37 mango trees, some of which were 16 years old and none of which had ever fruited, led to unsatisfactory results, blossom formation being induced on only two of the trees. Performance records showed that Cambodiana is a valuable mango variety both in respect to quality and amount of fruit.

Tomato breeding was continued with a view to obtaining disease-resistant seedlings and to increasing the size of native tomatoes by crossing with commercial varieties. An F_1 cross between Lares Native and Stone showed resistance to an unknown disease which practically destroyed the entire tomato planting at the station. Examination of the progenies obtained by crossing a large native muskmelon with two commercial varieties showed no inheritance of the mildew-resisting quality which characterizes the native, leading the author to conclude that mildew resistance is not a dominant character. Time of ripening was inherited in the F_1 generation as an intermediate character. Netting was practically recessive, only a trace being observed about the stem end of the F_1 fruits. In a test of several English and American varieties of muskmelons, Rocky Ford, Berry, and Honey Dew were the only satisfactory sorts.

[Fruits and vegetables at the Yuma Experiment Farm, 1919 and 1920], E. G. NOBLE (*U. S. Dept. Agr., Dept. Circ. 221 (1922), pp. 28-35, fig. 1*).—Of a total of 6,670 seedling date palms growing on the experiment farm 703 bloomed in 1920, and of these 478 were male and 225 female. The fruits of 12 of these trees are described as of good quality, those of 29 as fair, and the remainder as inferior.

Among 1,600 seedling figs planted in 1912, 384 have fruited, and of these only 62 were classified as of fair to good quality. Brown Turkey and Black San Pedro figs were satisfactory in respect to size and quality of fruits. The fig known as S. P. I. No. 6952 bore larger fruits than any other variety. The Blastophaga insects, successfully wintered over in 1919-20, contributed to the increase of the size of crop and caused fruit to set on trees hitherto sterile. It is thought, however, that the insects caused seedling figs to develop qualities of the caprifig, with consequent reduction in quality.

Plantings of *Prunus davidiana*, established with a view to obtaining hardy stocks for the almond, peach, and apricot, succumbed to adverse environmental conditions. The Japanese persimmon, quince, pomegranate, jujube, pear, fig, almond, and pecan proved satisfactory, and it is thought that the olive and certain citrus fruits may also succeed. Thompson Seedless and Malaga grapes gave encouraging results. Strawberries suffered severely from excessive summer heat.

Extensive tests with species and varieties of vegetables reported upon in detail indicate that with proper attention to seasonal and cultural requirements a majority of the species may be grown with success.

Lettuce varieties, A. M. MUSSER and W. J. YOUNG (*South Carolina Sta. Bul. 215 (1922), pp. 16, figs. 5*).—A report upon tests of 51 varieties of lettuce, with descriptive and performance data presented in detail.

Fruits [at the Williston Substation], C. H. RUZICKA (*North Dakota Sta. Bul. 158 (1922), pp. 102, 103, fig. 1*).—This is a brief report upon the behavior of various fruits which have been grown with success at the substation. Among the more satisfactory varieties are Florence and Whitney crabapples, Wyant, DeSoto, and Forest Garden plums, Compass cherry, Houghton, Downing, and Red Jacket gooseberries, North Star, Red Cross, Fay, and White Grape currants, Marlboro, London, and Columbian raspberries, Beta grape, and Senator

Dunlap strawberry. Irrigation is deemed highly beneficial to all fruits; nevertheless, during the absence of water in the period 1915-1918 most of the fruits made fair progress.

Chemical and physiological studies on fruit storage, J. R. MAGNESS (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 169-172).—An account dealing with the construction and equipment of the Marble Laboratory, Inc., at Canton, Pa., and the nature of fruit storage investigations under way.

Transpiration rate of deciduous fruit trees as influenced by irrigation and other factors, A. H. HENDRICKSON (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 145-147).—A report of experiments conducted at Davis, Calif., to determine the possible relations between transpiration losses in the leaves of fruit trees and the moisture content of the soil.

The author found in prune, peach, pear, and apricot trees a marked variation in the rate of transpiration of different leaves in respect to their position on the branch. Under equal conditions of sunlight the young leaves near the vegetative end transpired at a slower rate than older leaves situated at the base of the branch. Apparently, the young leaves at the apex were unable to obtain sufficient water.

The rate of transpiration of spur leaves on 2-year-old wood of prunes and pears was found to be greater than that of leaves on shoots of the current season. The fact that the rate of transpiration increased from 8 a. m. to about midday and then decreased until 5 to 6 p. m. is believed to be due to the inability of the conducting tissue to supply sufficient water to support the higher rate of transpiration. This deficit of water occurs daily in the hot dry interior valleys of California, irrespective of the moisture content of the soil.

Transpiration readings taken upon the third and fourth leaves from the end of branches (terminal buds formed) of mature fruiting prune trees, part of which were irrigated to a depth of 6 ft. and part not watered, showed that for the 48 hours subsequent to watering the rate of transpiration of the irrigated trees was greatly increased. On the third day following irrigation no difference could be detected. Similar results were obtained in experiments with mature peach and apricot trees and with immature Bartlett pears.

Rootstock studies in Europe, W. L. HOWARD (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 250-255).—A report of a general nature presenting the personal observations of the author upon the fruit stock industry in Europe.

The Mahaleb cherry, found growing at random in hedges and on hillsides in the Rhone Valley near Lyons, France, was apparently adapted to a diversity of soil types. The Mazzard cherry, the seed of which is obtained largely in Normandy, occurs largely in mixed stands with various forest species. Myrobalan plum seed, gathered for the most part in northeastern Italy, was found to be extracted from a multiplicity of fruit types, seven distinct forms being distinguished by the author. A greater part of the French crab seed is obtained from seedling cider apple orchards in Normandy. However, some excellent apple and pear seed is procured in the vicinity of Steinmarkt, Austria. Walnuts were found to be grown practically altogether on seedlings of *Juglans regia*.

The season of application of nitrogenous fertilizer as affecting the chemical composition of spurs and bark, H. D. HOOKER, JR. (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 150-152).—The material presented in this paper appeared for the greater part in an earlier noted publication (*E. S. R.*, 47, p. 141).

A preliminary experiment on half tree fertilization, H. E. KNOWLTON (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 148, 149).—The application, in the

early spring of 1921, of 3, 5, and 9 lbs. of nitrate of soda to the lower side of three 25-year-old Rome Beauty trees growing on a hillside resulted in increased vigor in that portion of the limbs immediately above the treated soil. Determinations of total nitrogen in the buds and leaves gathered at intervals from both the treated and untreated sides of the tree receiving 5 lbs. of nitrate of soda showed no differences up to the twelfth day, at which time 12.6 mg. more of nitrogen per gram of dry weight were recorded for the fertilized side. On the twenty-first day the leaves of the nitrated side still contained more nitrogen. Analysis in the autumn of current growths from both sides showed no significant differences in nitrogen content.

Terminal growth measurements on treated and untreated sides of the three trees, arranged in tabular form, indicate that nitrogen favorably influenced the growth immediately above the treated area.

Observations upon the comparative resistance to freezing injury of the pistils of emasculated and bagged flowers on both sides of the trees treated with 3 and 5 lbs of nitrate of soda showed that nitrogen had a favorable effect upon the vitality of the pistil. On the 3-lb. tree, 21.1 per cent of live pistils were recorded for the fertilized side and 11.2 for the unfertilized side, with respective counts of 15.5 and 10.7 per cent for the 5-lb. tree. An incomplete examination of the pistils indicated that the pollen tubes from the fertilized examination of the pistils made a more rapid growth.

Length of life of apple trees based on observations in Virginia and Michigan, R. E. MARSHALL (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 203-206).—A popular discussion concerning the disparity in length of life between apples trees grown in the Northern and Southern States. The author, conceding that trees do actually live longer in certain of the Northern States, ascribes this greater longevity to a lesser prevalence of serious diseases, such as root rots, blister canker, etc.

Notes on the length of life of apple trees in Minnesota, W. B. BRIERLEY (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 211-213).—In a brief review of the factors believed to influence the longevity of apple trees in Minnesota, freezing injury is deemed to be the dominant limitation to long life, the average span being generally accepted as 30 years. A tabulation of varieties arranged according to expectancy of life, as computed from data obtained in reply to questionnaires, shows only 37.5 years for the longest lived variety, Hibernial.

Report of the horticultural section [Michigan Station], C. P. HALLIGAN (*Michigan Sta. Rpt.* 1921, pp. 197-199).—Spraying and dusting studies conducted in 1920 are again noted (*E. S. R.*, 47, p. 439).

A careful study of trees involved in bud selection studies with the Baldwin and Oldenburg (Duchess) apples indicated that differences in productivity are traceable in every case to variations in drainage, to root galls, to girdling, or to some physiological condition.

Apple orchard renovation, H. P. GOULD (*U. S. Dept. Agr., Farmers' Bul.* 1284 (1922), pp. 32, figs. 25).—A well-illustrated paper of a general nature dealing with the restoration of neglected apple orchards through the media of constructive pruning, tillage, fertilizers, cover crops, spraying, and sanitary operations. The author, in discussing the types of neglected orchards, emphasizes that all orchards are not worth the expense and effort of renovation. He illustrates and describes types of ideal trees, suggests methods of top-working old and young trees to more desirable varieties, and discusses natural braces as a means of preventing the splitting down of limbs in poorly formed trees.

The Russian apple in America, W. R. LESLIE (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 257-263).—Subsequent to a brief historical review of the intro-

duction of Russian apples into North America, the author emphasizes the important part that these fruits have played in the pomology of the North Central States and contiguous parts of Canada, and lists those varieties and seedlings of Russian parentage which are now grown in these areas. Two Russian apples, Oldenburg and Yellow Transparent, are grown extensively throughout all of the fruit-growing States. A bibliography of 22 titles is appended.

[The Siberian crab apple at the Dickinson Substation], L. MOOMAW (*North Dakota Sta. Bul. 160 (1922), pp. 29, 30*).—The Siberian crab apple was found more productive than larger fruited varieties, and yielded fruits which despite their bitterness and astringency made a very satisfactory jelly.

Pollination of the sweet cherry, C. E. SCHUSTER (*Oregon Sta. Circ. 27 (1922), pp. 3*).—Information of a general nature is presented concerning self- and intersterility in the sweet cherry as grown in Oregon. The necessity of adequate interpollination is discussed, and varieties suitable for this purpose are recommended, with information concerning the number of trees required and the value of honeybees as carriers of pollen.

Supports for vines, F. T. BIOLETTI (*California Sta. Circ. 252 (1922), pp. 19, figs. 15*).—This is a presentation of information of a practical nature pertaining to the materials required and methods used in erecting various types of trellises and supports for California vineyards.

Filberts, C. E. SCHUSTER (*Oregon Sta. Circ. 28 (1922), pp. 3*).—This circular presents general information relative to soils, propagation, planting, culture, pruning, harvesting, and varieties and pollination.

The production of tulip bulbs, D. GRIFFITHS (*U. S. Dept. Agr. Bul. 1082 (1922), pp. 48, pls. 20*).—A comprehensive and adequately illustrated paper presenting practical information relative to tulip bulb production under American conditions. On the basis of investigations conducted over a period of years at Bellingham, Wash., and upon a thorough knowledge of the industry, the author emphasizes that bulbs of excellent quality and suitable for all purposes may be profitably produced in favorable parts of the United States.

Among the subjects discussed in the paper are the structure of bulbs and method of reproduction, soils and their preparation, planting, cultural operations, age of flowering bulbs, blindness, relation of size of bulb to size of flower, relation of early maturity to blossoming, harvesting, storage, curing, cleaning, grading, and packing for shipment. The various implements required are described. Information is given relative to the distribution of labor, the maintenance of fertility, and the control of various insect and fungus pests. The phenomena of breaking and its possible relation to mosaic disease is briefly discussed. It is pointed out that varieties differ sharply in the quantity of new bulbs produced, and tables are presented showing the effect of size and spacing of mature bulbs upon the number and size of progeny. Yields for many varieties are presented in tabular form.

FORESTRY.

Guide to forestry, J. S. ILLICK (*Penn. Dept. Forestry Bul. 26 (1922), pp. 83, figs. 41*).—A pamphlet of a popular nature, designed to instill an appreciation of forests and the necessity for their preservation from fire and other injury and to give general information for assisting the youth and amateur in identifying these forest species grown commonly in Pennsylvania. Information is presented relative to the location of the State forests, their principal features, and purposes.

Field manual of trees, J. H. SCHAFFNER (*Columbus, Ohio: R. G. Adams Co., 1922, 2. ed., pp. 154*).—With the exception of a few minor changes, this

little handbook is essentially the same as the previously noted, earlier edition (E. S. R., 30, p. 645).

Studies with mahogany and Spanish cedar, E. PICCIOLI (*Staz Sper Agr. Ital.*, 55 (1922), No. 1-3, pp. 51-79, figs. 6).—A report of technical studies in which several species of *Swietenia* and *Cedrela* were examined in respect to anatomical structure, breaking and crushing strengths of wood, etc.

Minor forest products of the Malay Peninsula, F. W. FOXWORTHY (*Malayan Forest Rec.*, No. 2 (1922), pp. 151-217).—Various jungle products, namely, rattans, gutta-percha, gums, oils, tanbarks, dyestuffs, fibers, medicinal and food plants, etc., are considered in relation to their botanical source, method of procuring, commercial value, and economic uses. The medicinal plants are listed in tabular form, with botanical and common names, and purposes for which used.

Forest products laboratory: A brief account of its work and aims (U. S. Dept. Agr., Dept. Circ. 231 (1922), pp. 47, figs. 23).—A popular discussion of the organization, equipment, projects under way, and operating policies of this unit of the U. S. D. A. Forest Service, located at Madison, Wis.

The forest products laboratory: A decennial record, 1910-1920 (Madison, Wis.: [U. S.] Forest Prod. Lab., 1921, pp. [8]+196, figs. 32).—In this account, published by the Decennial Committee, H. F. Weiss, chairman, information of a somewhat popular nature is presented relative to the history, organization, activities, and accomplishments of the laboratory during the initial 10 years.

The national forests of New Mexico (U. S. Dept. Agr., Dept. Circ. 240 (1922), pp. 21, pl. 1, figs. 7).—A circular of general information relative to the national forests in New Mexico, emphasizing their value as a source of merchantable timber, as grazing areas for a large number of live stock, and as recreational points for travelers and health seekers. The six forests, comprising a gross area of 9,500,000 acres, bear a stand of 15,000,000,000 b. ft. of saw timber and other forest products. The respective forests are described in detail in reference to location, accessibility, forest, grazing, and mineral resources, and recreational features.

Trees in windbreak [at the Dickinson Substation], L. MOOMAW (*North Dakota Sta. Bul.* 160 (1922), p. 29).—Despite the unusually adverse moisture conditions which have prevailed in North Dakota during recent years, a high percentage of survival was found in bull, Scotch, and jack pine plantings established about 1908. Black Hills spruce planted in a somewhat less favorable situation suffered very severe losses. The maximum heights in the three pine species were 17.5, 17.25, and 16 ft., respectively.

[Forestry studies at the Williston Substation], C. H. RUCICKA (*North Dakota Sta. Bul.* 158 (1922), pp. 100, 101, 102).—Among several native and introduced tree species, the behavior of which is briefly commented upon in this report, the Russian olive, golden willow, Canadian poplar, Black Hills spruce, American elm, green ash, and box elder have proved hardy and drought resistant. Where planted as windbreaks, trees have afforded effective and beneficial shelter to live stock.

Second annual report of the forestry commissioners for the year ending September 30, 1921 ([Gr. Brit.] *Forestry Commrs. Ann. Rpt.*, 2 (1921), pp. 44, pl. 1).—A progress report (E. S. R., 46, p. 541) for the year ended September 30, 1921, in which a considerable amount of experimental data is presented in addition to general administrative information relating to policies, planting programs, utilization of funds, weather relations, etc.

A tabulation of the results of a time of planting test conducted in the Rapley nursery, Windsor Forest, with seed of five forest species, namely, silver and Douglas firs, Sitka and Norway spruces, and European larch, indicated a variability in the optimum date of sowing in relation to species. Certain species, for example, Douglas fir, produced only a comparatively small percentage of plants. The results obtained from the immersion of seeds in water for 2, 7, 14, and 21 days previous to planting showed that the 7 and 14 day periods were favorable to germination in the case of the four species, silver fir, Sitka and Norway spruces, and European larch. Soaking for 21 days was quite apparently injurious to the viability of the seed. Pregermination tests at the Rapley nursery and at Oxford, in which seeds were partly sprouted in artificial media before sowing, indicated that under carefully controlled temperature and moisture conditions pregermination may increase not only the number but the size of the seedlings.

In comparing autumn and spring sowing of seeds at the Craibstone and Beaulieu nurseries, Scotland, it was found that autumn planting was very successful except with the European and Japanese larches, which suffered from frost injury during germination. In the instance of the other trees, Scotch pine and Douglas and Sitka firs, not only a higher germination but also much larger seedlings resulted from fall planting.

Experiments at Oxford indicated that spruce seedlings may be severely injured by exposure for 30 minutes to a temperature of 45 to 46° C. In Scotch pine the critical temperature was higher but apparently well below 50° (122° F.). Since temperatures of 120° F. often occur at soil level, it is deemed probable that heavy losses are incurred from this source, and it is recommended that overhead shelters be used to prevent losses from overheating. Studies at the Rapley nursery indicated that overhead shelters, preferably lath gratings, were of great benefit in preventing injury from drought. The shelters proved more beneficial than watering in the case of certain species, for example, Sitka spruce.

Experiments conducted in three Scottish nurseries indicated that protection from frost is of value in preventing the heaving of plants, especially conifers. The amount of injury was found to be correlated with the thickness and age of the stand, the amount of water in the soil, and the severity of the weather.

Efforts to eradicate weeds from seed beds by the use of chemicals led to no conclusive results. Tests with sand, subsoil, top soil, and compost as media in which to grow seedlings indicated that much time in weeding may be saved by the use of sand or subsoil to cover the seed. A study of the cost of weeding in broadcasted and drilled beds showed no appreciable difference in cost of weeding between the two methods during the initial year.

Seed taken from Scotch pine cones gathered in September, October, February, and April from the same trees were tested for germination at the Edinburgh Seed Testing Station, but the results show no evidence of any influence due to the date of collection. A difference of 30 per cent in germination recorded in favor of seed extracted at the station as compared with similar seed extracted at a commercial nursery, is believed to have been due to the temperature at which the station seed was extracted.

Reports of forest administration in Burma for the year ended June 30, 1920, and for the period July 1, 1920, to March 31, 1921, F. A. LEETE, S. F. HOPWOOD, G. K. PARKER ET AL. (*Burma Forest Admin. Rpts.*, 1920, pp. 12+190, pls. 4; 1921, pp. 8+14+180, pls. 7).—These administrative reports present the usual information relative to finances, alterations in area, and silvicultural operations (E. S. R., 45, p. 646).

DISEASES OF PLANTS.

Methods of direct inoculation with damping-off fungi, A. E. RATHBUN (*Phytopathology*, 11 (1921), No. 2, pp. 80-84, figs. 3).—The development of new or modified methods is outlined, the results from which are to be detailed elsewhere, regarding direct inoculation. This involves in the present case both stems and roots in order to eliminate the possibility, assumed in case of previous work indicated, that the great variability noted in the relative virulence of the different strains of fungi may have been due at least in part to the inability of some of the strains to maintain themselves saprophytically in the soil until the seeds had begun to germinate.

The direct inoculation of stems indicates that there is considerable variability in the relative virulence of the different strains, and that a few of them were formerly considered nonparasitic apparently because of their inability to live in the soil. The inoculations of taproots indicate that although the method should be tried out more extensively before definite conclusions are drawn, good results can be secured by its continued use. The experiments with dormant seeds apparently confirm the assumption that by far the greater part of the germination loss is caused by the attack of radicles which have just emerged from the seed coats.

Mosaic cross-inoculation and insect transmission studies, O. H. ELMER (*Science*, 56 (1922), No. 1448, pp. 370-372).—As opposed to the theory that there are several types of mosaic which are limited as to host range, the author presents evidence showing that mosaic can be transmitted to a number of species of plants belonging to widely separated orders and families. Cross-inoculations with infected tissues and plant juices, inserted by means of a scalpel or hypodermic needle, successfully transferred the disease. An undetermined aphid, as well as the mealybug *Dactylopus* sp., was found capable of transferring the cause of the disease from one plant to another.

The results of the author's experiments indicate that the mosaic which he had under investigation is intertransmissible between species of Cucurbitaceae, Solanaceae, and Leguminosae. The author believes that infection with mosaic is, to a large degree, determined by the growth condition of the plant, the optimum condition being an unchecked, vigorous growth. Inoculations within the Solanaceae or Cucurbitaceae were more readily effected than cross-inoculations between members of these families. Successful cross-infections between members of different families were found to be more easily obtained with plants growing under favorable than under unfavorable conditions.

Action of some alkaloids on *Botrytis cinerea*, P. NOBÉCOURT (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 11, pp. 706-708).—Experimentation showed that nicotine and atropine in the small proportions ordinarily present in *Nicotiana* and in *Atropa* do not harm or hinder the parasitic fungus *B. cinerea*. Quinine shows unfavorable action when present in high percentages, and aconitine does the same in very weak doses.

A form of disease ascribed to a sterile form of *B. cinerea* is said to be more virulent than the conidial form but to be less resistant to alkaloids than the common form of *B. cinerea*. Plants, higher or lower, appear to be less sensitive to the injurious effects of alkaloids than are animals, and even to be able to utilize certain of these compounds.

The protective significance of Uspulun, especially as a seed treatment, G. KÖCK (*Zentbl. Agr. Chem.*, 50 (1921), No. 4, pp. 134-140).—Uspulun, containing sodium sulphate, sodium hydrate, aniline, and mercury chlorophenol (the last named being the principal effective component), is discussed as to its composition and its fungicidal effects, and also its influence on germination.

Germination was depressed by high concentration. Uspulun also decreased smut infection of wheat. Experimentation with other crops is briefly discussed.

Uredinales collected by R. Thaxter and J. B. Rorer in Trinidad, J. C. ARTHUR (*Bot. Gaz.*, 73 (1922), No. 1, pp. 58-69, figs. 4).—A study by the author revealed that about 45 Uredinales, secured by Thaxter during a visit to Trinidad, 1912-13, have been found to represent 37 species of rust in 14 genera. Two of the species, apparently undescribed, are indicated as *Cerotelium minutum* n. sp. and *Maraschia pallida* n. g. and n. sp.

Plant diseases of 1921 in Quebec, B. T. DICKSON (*Quebec Soc. Protect. Plants, Ann. Rpt.*, 14 (1921-22), pp. 52-58, figs. 8).—The year 1921 in Quebec was typically a year of Fusarium root rots and of mosaics. These notes indicate the chief diseases present.

Field peas were severely attacked by *F. lathyri* beans by *F. martii phaseoli*, and asters by *F. orthoceras*. It was difficult to grow sweet peas in any light soil owing to the heavy infection by *F. lathyri* in July and August.

Mosaic, though lessened as to severity by the systematic efforts on the part of the authorities, was prevalent on clovers, beans, raspberry, sweet pea, tomato, and tobacco, and the field pea was determined as a new host.

A potato disease (black dot) due to *Uromyces varians* was discovered by the author, but it was serious only in certain areas.

Late blight became pronounced after September 1. In storage during the middle and late winter, extensive rotting occurred which is ascribed to *Fusarium* spp. and *Phytophthora infestans*. Onion smut (*Uromyces cepulae*) was serious in one or two market gardens near Montreal. Beans were affected by anthracnose but more so by blight (*Pseudomonas phaseoli*).

Sunflower Sclerotinia disease, present for two seasons, reached 2 per cent in one experimental plot. Soft rot of cabbage, cauliflower, and turnip was found in a few localities. Rhizome rot of iris, caused by *Bacillus carotorous*, was prevalent on the island of Montreal and caused the loss of about 120 varieties during the previous 5 years. Rhubarb showed a leaf spot due to *Phyllosticta straminea* and a leaf rot due to *Colletotrichum erumpens*. Peonies were affected slightly by Botrytis blight and seriously by a leaf spot disease.

Apple scab was well controlled, black rot was common, and silver-leaf was not serious. Plum brown rot (*S. cinerea*) and bladder plums (*Eriocrasus pruni*) were fairly common. Raspberry curl was severe.

Observations on wheat scab in Pennsylvania and its pathological histology, J. F. ADAMS (*Phytopathology*, 11 (1921), No. 3, pp. 115-124, pls. 2, fig. 1)—Wheat scab (*Gibberella saubinetii*) in Pennsylvania, observed in most cases as attacking the head, is said to be present in all of the wheat-growing portions of the State, the percentage ranging as high as 8 per cent, with an estimated average in 1917 of 2 per cent. Though seedling infection is no doubt a serious phase of the disease, it is probable that soil and temperature conditions with the planting of wheat in the fall are not conducive to seedling infection.

This disease is more serious in fields following the planting of corn, and the evidence is quite convincing that in part the source of inoculum comes from the development of the same fungus on cornstalks.

Observations of infected and inoculated kernels indicate that the fungus, if once established, will destroy the embryo. Inoculation experiments support the evidence that under favorable conditions *G. saubinetii* may become a virulent parasite of wheat seedlings. A study of infected kernels from various parts of the State, collected at the time of harvesting, indicates that the prevalent type of infection occurs after the flowering stage.

Relation of spore load to the percentage of stinking smut (*Tilletia tritici*), F. D. HEALD (*Phytopathology*, 11 (1921), No. 2, pp. 103, 104).—Artificial smutting was accomplished by adding from 0.005 to 3 gm. of smut to 100 gm. of wheat, these amounts giving a spore load of 400 to 183,000 spores per grain. Maximum smutting was obtained with a spore load of 65,000 to 100,000 spores per grain, as determined by microscopic counts with a Levy cell. A spore load of 533 per grain produced 9.5 per cent of smut in Jenkins Club, but a similar load for Marquis produced no smut. Farm-infected seed planted in the spring does not smut as much as winter wheat carrying an equivalent load. This study has made it possible to examine samples of wheat and predict with reasonable accuracy the amount of smut which might appear in the crop if no seed treatment is practiced. It has also shown that much spring wheat is treated when the spore load is so low as to give a negligible amount of smut in the absence of treatment.

Copper carbonate for wheat smut control, H. P. BARSS (*Oregon Sta. Circ.* 30 (1922), pp. 3).—Preliminary tests made in a number of places in Oregon are said to have shown satisfactory results for the control of wheat smut by the use of copper carbonate. Directions are given for the use of copper carbonate, and attention is called to the fact that only a good grade of this material should be used. If thoroughly mixed, 2 oz. is sufficient for treating a bushel of wheat.

Attention is called to the fact that copper carbonate treatment will not be found satisfactory for oats or barley.

A mosaic of sweet and red clovers, J. A. ELLIOTT (*Phytopathology*, 11 (1921), No. 3, pp. 146-148, fig. 1).—The mosaic of sweet clover (*Melilotus alba*) first came to the author's attention in 1917, about 50 per cent of the sweet clover plants on the University of Arkansas campus being affected. Inoculations were attempted on several apparently healthy plants, the results in all cases being positive. Several mosaic plants were marked for further observation, and all of these which grew the following year showed the disease.

In September, 1919, the red clover (*Trifolium pratense*) also showed marked symptoms of the disease, at least 75 per cent of these plants on the campus being very severely attacked, with very pronounced symptoms. All attempted cross-inoculations were successful, the disease thus appearing to be identical on the two plants.

To check the work done with transplanted plants, seeds were planted in pots in the greenhouse of horse bean (*Vicia faba*), alfalfa, white clover, sweet clover, spotted bur clover (*Medicago arabica*), and red clover. Two plants of each species were inoculated from each of the two sources of infection, diseased sweet and red clover. Inoculations from both sources appeared equally virulent on the different plants proving susceptible, which included sweet clover, red clover, bur clover, and horse bean. The disease appeared to be extremely virulent on the spotted bur clover. A large red clover plant used as one of the sources of inoculum was afterwards permitted to grow in the greenhouse throughout the winter. In the spring it was noted that all signs of mosaic had disappeared from this plant, though the disease had remained throughout the winter on sweet clover, horse bean, and bur clover. Crushed leaves from this plant failed to inoculate healthy red clover and sweet clover plants, but it was again inoculated from a bur clover plant.

Mosaic of beans and cowpeas is said to be very common in Arkansas, both showing an extreme type of the disease in many instances. It appears that the diseases of these various plants are identical.

Mosaic from sweet and red clover infected *Trifolium*, *Melilotus*, *Vicia*, and *Medicago* with apparently equal facility.

Rust of onion followed by a secondary parasite, J. C. WALKER (*Phytopathology*, 11 (1921), No. 2, pp. 87-90, figs. 2).—The occurrence of an aecial stage of rust was noted on leaves and seed stems of top onion (*Allium cepa bulbellifera*) at Madison, Wis., in June, 1920. Specimens are said to have been diagnosed by J. C. Arthur as probably a case of *Puccinia asparagi*, crossing to onion, which supposition was supported by the fact that the two infected onion plants were separated by a patch of asparagus. No aecial form was noted at the time on the asparagus, which had been closely cut up to that date. On September 16, however, many of the asparagus seed plants bore an abundance of uredinia and telia of *P. asparagi*. The description given of the aecial stage on onion agrees closely with that of the asparagus rust, which is said to have been successfully crossed to onions, producing all three stages thereon.

On June 27 the infected onion plants showed invasion by a secondary organism by way of the rust sori. It is thought considerable damage might be caused by an attack on seed plants of the common onion. A pure culture of the *Botrytis* form found in connection produced no decay after inoculation into white onion bulbs.

Observations upon the bacterial blight of field and garden peas in Montana, H. M. JENNISON (*Phytopathology*, 11 (1921), No. 2, p. 104).—The most serious disease of seed peas grown in southwestern Montana is the bacterial blight caused by *Pseudomonas pisi*. Dissemination of the disease is thought to be due largely to contaminated seed. Under favorable weather conditions spread of the infection in the field is rapid and scarcely controllable. Differences in susceptibility to attack by the blight have been noted in about 40 varieties of garden and field peas, Alaska being one of the most susceptible.

Soft rot of pepper fruits, S. G. LEHMAN (*Phytopathology*, 11 (1921), No. 2, pp. 85-87).—A new disease of cultivated sweet peppers (*Capsicum annum grossum*) which appeared in West Raleigh during the July wet weather, 1920, is described in connection with the organism. The fungus is believed to be *Pythium debaryanum*. Infection occurs supposedly by means of zoospores, splashed on the plants from the ground by rain and enabled to enter the plants in consequence of wounds produced by insects, though as yet no insects have been shown to be responsible for such injury.

[Potato] diseases and their control, P. KNORR (*Arb. Forschungsinst. Kartoffelbau*, No. 6 (1922), pp. 114-121).—These pages deal with Perocid as used against Phytophthora, varietal susceptibility to canker, the influence of tuber disinfection and soil sterilization on the following growth and yield, mosaic disease, the importance of the Verticillium wilt on different varieties, heart rot, the effect of potassium in fertilizer on tuber rot, and nematodes.

[Potato breeding for immunity], E. BAUMANN (*Zentbl. Agr. Chem.*, 50 (1921), No. 7, pp. 253-256).—Tests with two potato varieties are detailed as applying to the morphological elements and the ecological conditions for yield, and to desirable qualities indicated.

The transference of potato late blight by insects, W. J. MORSE (*Phytopathology*, 11 (1921), No. 2, pp. 94-96).—Observations cited would indicate that potato late blight may under favorable conditions be carried long distances from field to field. In the case in question a small greenhouse maintained for use with plant disease work became infected with late blight (*Phytophthora infestans*) starting near an open window. The infection appeared to come from diseased potatoes about 150 yds. away, and since aerial transference appeared improbable, it is thought that either flea beetles or potato aphids acted as carriers.

[**Potato canker control**], E. SCHAFFNIT (*Zentbl. Agr. Chem.*, 50 (1921), No. 7, pp. 256-258).—Studies during 1918-19 showed but little success as regards control of potato canker through soil fertilization or disinfection. Resistance tests are noted with varieties proving resistant.

A note on the corrosive sublimate treatment for the control of Rhizoctonia, H. W. THURSTON, JR. (*Phytopathology*, 11 (1921), No. 3, pp. 150, 151).—In the spring of 1918, in connection with certain investigations on potato-seed treatments at the University of Nebraska, the author made plate cultures of *Rhizoctonia* from potato tubers treated with HgCl_2 solution at varying strengths and for varying periods. In view of the recent studies of Melhus and Gilman (*E. S. R.*, 47, p. 248), it is considered advisable to present these data in brief form.

Tubers bearing sclerotia were soaked in corrosive sublimate, then rinsed in water. The sclerotia were picked off and transferred to potato agar, which was kept three days at 27 to 30° C. The results as presented in tabular form show much better control in the shorter treatments with 0.001 HgCl_2 and also with 0.002 HgCl_2 than that reported by Melhus and Gilman.

The skin spot (*Oospora pustulans*) of the Irish potato, F. D. HEALD (*Phytopathology*, 11 (1921), No. 2, pp. 104, 105).—Potato skin spot was found in several carloads of Gold Coin potatoes shipped to the Spokane market from British Columbia, 95 per cent of the tubers showing lesions. The fungus appeared identical with *O. pustulans*, described as the cause of the skin spot in England. It has not yet been determined whether the disease will develop under Washington conditions.

Sclerotial disease of the potato, O. W. LACHAINE (*Quebec Soc. Protect. Plants, Ann. Rpt.*, 14 (1921-22), pp. 105-109, figs. 6).—During the summer of 1921 the author found in different fields in New Brunswick 1 to 10 per cent infection of potato with sclerotial disease, which so far as studied appears to be identical with *Sclerotinia libertiana*.

[**Chlorosis of rice**], L. G. WILLIS and J. O. CARRERO (*Porto Rico Sta. Rpt.* 1921, pp. 8, 9).—In connection with studies of the use of fertilizers on rice, the authors found that when nitrates were applied to sandy soils the plants grew normally until the time of the appearance of the fourth leaf, after which new leaves invariably showed signs of chlorosis. In general, the observations made closely agree with the results of studies previously reported (*E. S. R.*, 44, p. 242).

During the year covered by the report a study was made to ascertain whether unfavorable action of nitrate fertilizers on rice is due to the effect of unassimilated residues of the physiologically alkaline salts on the availability of iron in the soil. The results obtained are believed to indicate that chlorosis, due to a lack of assimilable iron, occurs only on certain soils and under definite conditions. On the red soils chlorosis did not follow treatments with hydrated lime in any amount up to 5 per cent, nor did it occur at any degree of alkalinity up to pH 8.7, nor with any form of nitrate or ammonium salt used as a fertilizer. On the sandy soil, naturally alkaline with carbonate of lime, chlorosis followed the application of certain fertilizers. Where nitrates or ammonium phosphates were used in sufficient quantity to promote thrifty plant growth, chlorosis invariably followed. This led to the belief that the development of lime-induced chlorosis of rice and possibly of other plants in calcareous soils is governed not by the precipitation of iron in the soil by the lime but by the kind of fertilizer salts that are used and the nature of the unassimilated residues.

External factors affecting the sex ratio in beet nematodes, E. MOLZ (*Zentbl. Agr. Chem.*, 50 (1921), No. 7, pp. 258-262).—The considerable relative

numerical increase of the females of *Heterodera schachtii* in beets showing a rank growth after being supplied abundantly with fertilizer, particularly when nitrogenous in character, and leading finally in such soil to abnormally early and severe attack by the nematodes, is noted, with a statement regarding conditions favoring increase of the sex ratio females:males. These conditions include moderate supplies of well-rotted horse manure or beet leaf compost. A relative increase of males followed reduction of the soil nutrients by more frequent planting of beets. Precocity and vigor of the plants favored a relatively large increase of females, as did also the increase of assimilating leaf surface.

[Catch plant methods for combating nematodes], H. C. MÜLLER and E. MOLZ (*Zentbl. Agr. Chem.*, 50 (1921), No. 7, pp. 262-266).—The catch plant method of combating nematodes was modified by killing the catch plants with a corrosive liquid. The plan gave for the first year a considerable increase in the returns from beets. The crop was doubled in case of oats and barley, though intensive green manuring and soil cultivation doubtless played a considerable part. Iron sulphate gave somewhat less favorable though still considerable results. Barley, alternated with one beet crop and two following catch crops killed with 30 per cent iron sulphate, gave about double the yield given by the controls. By this plan no year's crop is lost. Questions raised are outlined.

The conclusion reached is to the effect that beet nematodes (*Heterodera schachtii*) can by this method, without employing the plowing method (involving expense and loss of time), be effectively disposed of, increasing greatly returns from infested ground.

Transmission of cane mottling disease through insects, C. E. CHARDON and R. A. VIVE (*Rev. Agr. Puerto Rico*, 9 (1922), No. 11, pp. 9-20, figs. 2; *trans. in La. Plante*, 69 (1922), No. 19, pp. 323-325, figs. 2) —Studies are here recorded confirming the conclusions reached by Brandes (*E. S. R.*, 43, p. 547; 44, p. 49), with the added advantages that their experiments were made in the open field and that they are able to offer what they regard as a satisfactory explanation in regard to the problem of mosaic transmission.

From the evidence here offered, it is considered safe to conclude that in several species of grass which are abundant in cane fields, two species of plant lice prevail, *Aphis maidis* and *Carotima* sp., which after the grass has been cut move to the sugar cane, feeding on the tender leaves. It is thought that during the short period in which these insects remain on the sugar cane they transmit the infectious substance of the mottling of sick plants to sound plants, thus reproducing the disease.

Blackfire or angular leaf spot of tobacco, F. D. FROMME and S. A. WINGARD (*Virginia Sta. Tech. Bul.* 25 (1922), pp. 43, pls. 2, figs. 18) —The results are given of five seasons' studies on blackfire or angular leaf spot of tobacco due to *Bacterium angulatum*. On account of resemblances to wildfire caused by *B. tabacum*, comparisons with that disease are included. A number of other leaf spots of tobacco are briefly described.

According to the authors, the blackfire disease occurs throughout the tobacco regions of Virginia, a survey made in 1920 showing that it was present in 85 per cent of the fields inspected. Wildfire was found less prevalent than blackfire, it being observed in only 17 per cent of the fields. Both diseases are said to occur on seedlings in the plant bed, and the occurrence of blackfire in the field and the severity of losses are determined in large measure by the occurrence of infection in the plant bed. The blackfire pathogene is said to be seed borne, and seedling infection may be usually traced to the use of infected

seed or contaminated plant-bed cloth, on which the organism may overwinter. It is known to overwinter also in tobacco refuse and to some extent in the soil. Severity of infection is claimed to be modified greatly by rainfall and host nutrition, the plants which make rapid, succulent, vigorous growth being most subject to injury.

For the prevention of blackfire the authors recommend disinfection of the seed with formaldehyde or corrosive sublimate solutions. Little or no injury is done to the seed if properly treated. In addition to the use of disease-free plants for transplanting, it is recommended that field rotation should be practiced wherever possible.

Peronospora disease [of tobacco], O. F. BURGER (*Florida Sta. Rpt. 1921*, pp. 26, 27).-- A progress report is given of this investigation.

The biology of *Schizophyllum commune* with special reference to its parasitism, V. A. PUTTERILL (*Union So. Africa Dept. Agr., Sci. Bul. 25 (1922)*, pp. 35, figs. 16).--The investigations here described relate to the question of the parasitism, hitherto assumed but not proved, of *S. commune*, which fungus occurs on living apricot trees in the Cape Province.

In its action, *S. commune* is found to make use primarily of the cellulose constituents of the wood and not to delignify it, as is more common with wood-destroying fungi. Starch is absent from the infected wood owing supposedly to the activities of the parasite, which also seems to be the cause of the production of copious quantities of gum in the diseased tissues.

Tests for enzymes secreted by the fungus when grown in pure culture in a liquid medium confirmed its ability to produce cytase and diastase, and prove production as well of emulsin, invertase, maltase, and lipase. The work on the growth of the fungus in pure culture was intended merely to supplement what had been done previously by other investigators.

Experiments on spore germination showed that spores from a fresh spore-print germinate feebly in distilled water but readily in a nutrient solution, this power of germination being lost in about 12 days. Of about 16 inoculations carried out with *S. commune* from pure culture on stone fruit trees, 12 gave positive results, the other 4 on roots, green shoots, and stems of young almond trees being inconclusive. *S. commune* was recovered in every instance from the discolored wood, though a sporophore was produced in one instance only.

These inoculations proved that *S. commune* can grow in living wood, which it kills. Though the harmful effects resulting from its growth may not be immediately apparent, the total damage is probably considerable.

[A study of diseases of citrus fruits in transit], H. C. HENRICKSEN (*Porto Rico Sta. Rpt. 1921*, pp. 26, 27).-- A preliminary report is given of studies made of the diseases of citrus fruits which caused considerable loss during the shipment of these fruits. It is stated that practically all decay of Porto Rican grapefruit is due to stem-end rot caused by the fungus *Diplodia natalensis*. This fungus normally enters the fruit through the short stems when cut, or through the cavity if the stem is pulled from the fruit. The *Diplodia* fungus is reported as present in orchards, and infection may be introduced by the clippers used in harvesting the fruit. Suggestion is given for the prevention of infection during the gathering and packing of the fruit.

The increase in resistance to citrus canker with the advance in maturity of citrus trees, H. A. LEE (*Phytopathology*, 11 (1921), No. 2, pp. 70-73).-- In the present paper (E. S. R., 47, p. 845) the hypothesis is offered, as based on field observations made at different places, that as citrus trees advance in maturity there is a gradual increase in resistance to citrus canker.

The resistance to citrus canker of *Citrus nobilis* and a suggestion as to the production of resistant varieties in other citrus species, F. T. McLEAN and H. A. LEE (*Phytopathology*, 11 (1921), No. 3, pp. 109-114a, fig. 1).—Field observations at Lamao, P. I., during 1917 upon the degree of citrus canker affection of the horticultural varieties of the mandarin orange (*Citrus nobilis deliciosa*), showed usually a few cankers to each tree, though the trees were never seriously affected. The mandarin varieties have been considered by Wester (E. S. R., 36, p. 851) to be truly resistant, and Stirling (E. S. R., 32, p. 345) has made a similar statement for the Castalo tangerine. Lee (E. S. R., 41, p. 751) has also reached the same conclusion for the mandarin varieties.

The observations and experiments here reported confirm this resistance. They also help to explain the nature of the resistance and suggest means of utilizing this quality. It appears that infections are in numerous cases coincident with visible wounds. This appears to have been substantiated experimentally, the results showing that these varieties were fully as susceptible as the grapefruit varieties after an entrance to the tissue has been made for the parasite. The suggestion is presented also that the periclinal chimera in which the epidermis is of *C. nobilis* might confer resistance on other very susceptible but desirable citrus species, while at the same time the character of the fruit would be but little changed.

An *Alternaria* disease of *Polypodium*, T. G. MAJOR (*Quebec Soc. Protect. Plants, Ann. Rpt.*, 14 (1921-22), pp. 59-61, fig. 1).—A supposedly hitherto unreported disease of *Polypodium* sp., which has been found in the experimental greenhouse at Macdonald College, is characterized by the occurrence of brown, concentrically zoned spots on the fronds and stems. The causal organism has been tentatively named *A. polypodii* n. sp. The disease has been experimentally produced by spraying a spore suspension of *A. polypodii* on healthy, sterilized fronds.

Experimental data on losses due to crown canker of rose, L. M. MASSEY (*Phytopathology*, 11 (1921), No. 3, pp. 125-134).—Since the publication of information previously noted (E. S. R., 38, p. 854) the author has obtained further data from experimentation extending over three years regarding the nature and extent of the losses due to rose crown canker, said to be caused by *Cylindrocladium scoparium*.

Opheila roses were grown under glass in infested and uninfested soil, and a record taken of the number of blossoms produced under these conditions, the losses caused by *C. scoparium* being measured by the reduction in the number of blossoms. It is held that losses are determined by the decrease in yields of blossoms and not by the death of the host.

Calcium sulphate, ammonium sulphate, potassium sulphate, acid phosphate, and lime under the conditions of this experiment exerted no influence on the losses caused by the parasite. A decrease of about 10 blossoms per plant represents the annual loss when plants are grown in infested soil.

Mildew and black spot were readily controlled by three or four applications of sulphur-lead dust, made at weekly periods, combined with judicious regulation of water and temperature.

Forest pathology in relation to forest conservation, J. H. FAULL (*Quebec Soc. Protect. Plants, Ann. Rpt.*, 14 (1921-22), pp. 14-22, figs. 5).—Investigation continued since 1918 on white-pine needle blight showed in 1919 that the trouble lay in the roots. The absorbing roots are found to be largely (due to some cause not yet known) dead in blighted trees. As a result of this, the sudden demand for a greatly increased water supply occurring when the new needles are expanding can not be met. The young needles first turn pale and

then redden from the tips down. Apparently other trees are more or less affected in the same way in the blighted areas. Sulphur gas injury and discoloration present much the same appearance and can be distinguished easily during the growing season only. Needle blight occurs at a definite period in relation to the emergence of the needles from the buds.

From results as tabulated for three years, it is concluded that young stands are not likely to be seriously depleted by needle blight. Injury to heavily blighted mature stands may be so great as to be a deciding factor in determining the time of harvesting. In regions subjected to sulphur fumes it is possible at a certain time to differentiate between blight and sulphur fume injury. The malady is not contagious.

A heart rot of birch was shown by a preliminary examination to be due to the true tinder fungus (*Fomes fomentarius*), which attacks standing or fallen beech, birch, poplar, and occasionally elm, abounding throughout Ontario and occurring frequently in adjoining States.

Contrary to views formerly common, this fungus enters living trees through wounds, breaks, or dead stubs, and penetrates both sapwood and heartwood, spreading rapidly. Timber cured while the decay is in its incipient stages is indistinguishable from sound timber. Infection of birch appears to be associated with the action of an insect boring at the crown.

***Thlephora terrestris*, *T. fimbriata*, and *T. caryophylla* on forest tree seedlings**, J. R. WEIR (*Phytopathology*, 11 (1921), No. 3, pp. 141-144, pl. 1).—An account is given of the occurrence of *T. terrestris* on nursery coniferous seedlings and other plants. The injury of coniferous seedlings by *T. fimbriata* and *T. caryophylla* is reported, supposedly for the first time.

***Polyporus dryadeus* on conifers in the Northwest**, J. R. WEIR (*Phytopathology*, 11 (1921), No. 3, p. 99).—It is said that *P. dryadeus*, the cause of heart rot in various dicotyledonous trees, especially oaks and poplars, occurs rather frequently on conifers in the Northwest. The fungus delignifies the heartwood of the base and roots of living trees and may be the cause of wind-fall. The fungus occurs most frequently on *Tsuga heterophylla* and *T. mertensiana*, but it has also been collected on *Abies grandis* and *Picea engelmanni*. Collections have been made on conifers from Washington, Oregon, Idaho, and Montana, and the fungus is also found on various oaks and maples in the West. This note is in verification of the report made by W. H. Long (E. S. R., 30, p. 354) on specimens of *P. dryadeus* collected on *T. heterophylla* in Washington.

***Septoria negundinis* in Zion National Park**, A. O. GARRETT (*Phytopathology*, 11 (1921), No. 2, p. 100).—In July, 1920, the author noted, during a visit to Zion National Park, Washington Co., Utah, that the leaves of box elder trees were affected by what is said to be *S. negundinis*, though some of the spores of the fungus were more than three celled.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

A key to Michigan vertebrates except birds, A. C. CONGER ([*East Lansing*]: Mich. Agr. Col., Zool. and Teacher-Training Depts., 1920, pp. 76).—This work includes brief descriptions of the more important vertebrates occurring in Michigan and a glossary of terms. The subject matter is made available by an index to the common names.

Life history of the kangaroo rat, *Dipodomys spectabilis spectabilis* Merr., C. T. VORHIES and W. P. TAYLOR (*U. S. Dept. Agr. Bul.* 1091 (1922), pp. 40, pls. 9, figs. 3).—This joint contribution of the Bureau of Biological Survey and the Arizona Experiment Station contains a summary of the results of investigations of the relation of a subspecies of kangaroo rat to the carrying

capacity of the open ranges, being one phase of a general study of the life histories of rodent groups as they affect agriculture, forestry, and grazing. The account is based upon investigations, chiefly in Arizona, of the life history, habits, and economic status of the banner-tailed kangaroo rat, *D. spectabilis spectabilis*. While this rat is not of great economic significance, except locally, in ordinary seasons, it may during periods of extreme drought be of critical importance on grazing areas from the standpoint of the carrying capacity of the range. Kangaroo rats are easy to poison by following the same formula as that used by the Bureau of Biological Survey for destroying prairie dogs.

The domestic rats, with suggestions for their control in field and barn, W. W. FROGGATT (*19r. Gaz. N. S. Wales*, 33 (1922), Nos 7, pp. 505-512; 8, pp. 593-597).—This paper deals with the brown rat (*Rattus norvegicus*) and the black rat (*R. rattus*) and means for their control.

Beaver habits, beaver control, and possibilities in beaver farming, V. BAILLY (*U. S. Dept. Agr. Bul.* 1078 (1922), pp. 31, pls. 7, figs. 7).—This bulletin, based upon extensive investigations by the author, discusses methods of dealing with beavers when their operations conflict with agriculture and other human activities, methods of transporting them to localities where they may be conserved as a valuable and interesting natural resource, and methods of utilizing them as an important supplement to the fur supply by establishing them in suitable climates, particularly in certain waste lands and other areas unsuited to agriculture.

Aviaries, bird rooms, and cages: Their construction and furnishing, H. NORMAN (*London: Cage Birds*, [1919], pp. 112, figs. 52).—This is a practical guide to construction, with appendixes on cage making and foreign bird keeping in aviaries, by W. Laskey and W. T. Page, respectively.

Frank Finn's manual on cage birds, F. FINN (*London: Cage Birds*, [1920], pp. [101], figs. 12).—This is a popular account.

Cage birds and parrots: Their care and management (*London: Spratt's Patent Ltd.*, [1920], rev., pp. 80, figs. 24).—This is a practical handbook.

The psychic life of insects, E. L. BOUVIER, trans. by L. O. HOWARD (*La Vie Psychique des Insectes*. Paris: Ernest Flammarion, 1918, pp. 300, figs. 16; New York: Century Co., 1922, pp. XVI+377, figs. 16; rev. in *Nature* [London], 110 (1922), No. 2760, pp. 402, 403).—The subject is dealt with as follows: Directive action of light, phototropism; the different external stimuli and the tropisms which they provoke; vital rhythms and the organic memory; differential sensitiveness; differential sensitiveness—species memory and simulation of death; individual or associative memory; spontaneous modifications of habits; evolution of instincts; comparative psychology—history of the pompilids; insects and flowers; the faculty of orientation; the faculty of orientation with terrestrial arthropods; the division of sexes with nest-making Hymenoptera; and the social life of arthropods.

Social life in the insect world, J. H. FABRE, trans. by B. MIALL (*London: T. Fisher Unwin, Ltd.*, 1922, pp. VIII+327, pls. 14).—This is the fourteenth impression of a work the English edition of which first appeared in 1911.

Entomology with special reference to its ecological aspects, J. W. FOLSOM (*Philadelphia: P. Blakiston's Son & Co.*, 1922, 3. ed., rev. [and enl.], pp. VII+502, figs. 313).—A revised edition of the work previously noted (E. S. R., 29, p. 555), which includes a new chapter on insect ecology, additions to the bibliography, etc.

Report of the entomologist, J. R. WATSON (*Florida Sta. Rpt.* 1921, pp. 29-33).—In the course of the root-knot investigations it was found that the most thorough eradication was obtained by the combination of sodium cyanid

at the rate of at least 1,200 lbs. to the acre and ammonium sulphate at the rate of 1,800 lbs. In observations of other animal life in the soil it was found that a dose of 600 lbs. of cyanid and 900 lbs. of ammonium sulphate killed all animals present, including white grubs (*Lachnosterna* sp.), crickets, mole crickets, earwigs, ants, termites, wireworms, and grasshoppers. On plats treated with 1,800 lbs. of cyanid to the acre and 2,700 lbs. of the sulphate, even Bermuda grass was killed. Where two-thirds of this dosage was used crab grass and all other vegetation above ground were killed, but in the case of heavy growths of Bermuda grass some underground stems survived.

Attention was given during the year to the effect of winter weather on the abundance of the velvet-bean caterpillar (*Anticarsia gemmatilis* Hubn.) the following summer. In experiments for the control of heavy infestations of thrips in citrus bloom during the spring in Lake, St. Lucie, and Brevard Counties, it was found that in order to insure a high percentage of killing, a solution of Blackleaf 40 should be used not weaker than 1 to 800 when used in combination with either lime-sulphur solution 1 to 70, or with soap, 4 or 5 lbs. to 50 gal. of water. The bean thrips found in the State once before, was observed abundantly infesting a patch of kudzu *Azaria ruidula* (L.) is reported to have caused considerably more damage than usual in tobacco fields at Madison, its origin having been traced in every case to near-by gardens.

Report of the section of entomology, R. H. PERIN (*Michigan Sta. Rpt. 1921, pp. 184-187*).—In reporting upon work with pear psylla, it is stated that lime sulphur is the most promising of all the sprays used to combat it, its application at a strength of 1 to 7 just as the blossom buds separate into clusters in the standard varieties being recommended. While in many cases Kiefer buds were found to be destroyed by it due to their advanced development, the death of the buds in this variety seems to be of less importance than the almost certain loss of the crop and possibly of the trees if the spray is not applied.

The fruit-tree leaf-roller (*Archips argyrospila*) is claiming attention in a few localities in the State, and in certain orchards near Muir it has been almost impossible to protect the trees. Scalecide at the rate of 1 part to 12.5 of water was applied by one orchardist at the time the leaf buds burst, with fair success.

Bordeaux mixture is the best repellent thus far tried in combating the potato leafhopper, and when Blackleaf 40 is added the immature hoppers that are hit are killed outright.

The use of sawdust-poisoned bait against grasshoppers is said to be effective and the most economical treatment. Blister beetles, the larvae of which feed on the eggs of grasshoppers, are said to be appearing in large numbers in regions that have suffered from grasshoppers the longest. It is stated that the State legislature of 1921 appropriated \$40,000 for the purpose of refunding to the counties and townships half of the sums used in the purchase and delivery of the poisoned bait. In order to determine the time at which the application of spray should be made against the larvae of the second generation of codling moth, cage observations were made at 12 different stations in various parts of the State, and the information gained made available. *Olethreutes abietana*, an enemy of blue spruce, was received from Ludington, Mich., where the small caterpillars were devouring the leaves. Work with the grape leafhopper and other insects is also briefly outlined.

Report of the entomologist, W. V. TOWER (*Porto Rico Sta. Rpt. 1921, pp. 23-26*).—In experimental tests made of a number of insects occurring on sugar cane with a view to transmitting mottling disease, negative results were obtained. A brief statement is made of the work with ticks and of the status of

the bee industry. There are said to be 98 dipping vats on the island at the present time, of which 19 belong to the insular government.

[Economic insects in Canada] (*Quebec Soc. Protec. Plants, Ann. Rpt., 14 (1921-22), pp. 9-13, 30-39, 42-52, 61-67, figs. 4*).—The several papers relating to this subject, presented at the annual meeting in March, 1922, are as follows: Some Early Forest Entomologists, by W. Lochhead (pp. 9-13); Gnats, Black Flies, *Simulia*, by J. C. Chapais (pp. 30-32); The Spruce Budworm in Quebec Province, by J. M. Swaine (pp. 32-39); A Few Points of Interest in Connection with Forest Entomology, by M. B. Dunn (pp. 42, 43); Experiments on the Control of the Onion Maggot, 1921, by W. Lochhead and W. J. Tawse (pp. 43-48); The Distribution of the European Corn Borer in Canada and the United States, by W. N. Keenan (pp. 48-52); How We May Increase the Effectiveness of Economic Entomology, by G. A. Dean (pp. 61, 62); and Some Insects Injurious to Shade Trees in Quebec, by G. Maheux (pp. 62-67).

The experimental control work with the onion maggot here reported upon was conducted in truck gardens in the vicinity of Montreal with a poison bait composed of 0.25 oz. of sodium arsenite dissolved in 1 gal. of boiling water to which 1 pint of cheap molasses was added. The bait was applied in two ways, (1) in shallow pans, about 20 to the acre and refilled every week for four weeks, and (2) as a spray with an ordinary watering can, first when the plants were 3 or 4 in. high, followed by four or five further applications made about a week apart. The details of experiments conducted on six farms are presented, and the results, which are summarized in tabular form, indicate that quite a high percentage of control was obtained, particularly from the pan method.

[Insect enemies of the coconut tree and other cultivated plants in São Thomé], A. F. DE SEABRA (In *Études sur les Maladies et les Parasites du Cacaoyer et d'Autres Plantes Cultivées à S. Thomé. Lisbon: Sect. Tech. et Path. Vég. Companhia Agr. Ultramarina, 1921, [pts.] 11, pp. 3-8, pls. 3; 13, pp. 11-13, pl. 1, figs. 6; 14, pp. 15-18, figs. 9; 15, pp. 11, pls. 7, figs. 11; 1920, [pts.] 21, pp. 6, figs. 4; 22, pp. 3-7, figs. 3; 23, p. 8*).—The papers here presented deal, respectively, with The Large Species of Insects Ravaging Old Trees in São Thomé (*Cerambycidae*) (pp. 3-8); The Occurrence of *Microceroterminus dolichognathus* Silv. in São Thomé (pp. 11-13), *Toxoptera coffeae* Niet. in São Thomé (*T. coffeae thomensis* n.s.sp.) (pp. 15-18), The Termites of Cacao Plantations (p. 11), Description of a Psyllid Ravager of the Leaves and Young Fruit of the Coconut Tree (p. 6), *Cosmopolites sordidus* Germ. in São Thomé (pp. 3-7), and A Note on the Agricultural Importance of *Lygidus varicolor* Berl. (p. 8).

The more important apple insects, A. L. QUAINANCE and E. H. SIEGLER (U. S. Dept. Agr., *Farmers' Bul. 1270 (1922), pp. 95, figs. 192*).—This is a summary of information on the more important insect enemies of the apple, together with control measures effective in combating them. Apple spraying schedules are appended.

Forest entomology, O. NÜSSLIN, rev. by L. RHUMBLER (*Forstinsektenkunde. Berlin: Paul Parey, 1922, 3. ed., rev. and enl., pp. XVI+568, figs. 457*).—This is a third revised and enlarged edition of the work on forest entomology previously noted (E. S. R., 20, p. 853).

Cheese pests and their control, E. R. DE ONG and C. L. ROADHOUSE (*California Sta. Bul. 343 (1922), pp. 399-424, figs. 9*).—This is an account of the more important cheese pests and work with preventive and control measures.

It is stated that cheese skippers and mites attack cheese in almost every part of the world, being widely distributed in the United States and frequently reported from the principal cheese-producing States. The loss is

occasioned through cheese actually eaten, the damaged appearance of attacked stocks, prejudiced customers, annoyance to manufacturers and dealers, and the expense of control measures. Cold storage of cheese at 30 to 36° F. is said to be the most practical method of preventing loss by either skippers or mites, and if cold storage is unavailable the cheese should be marketed while fresh.

"Paraffining cheese aids in protecting it from attack if the coating is unbroken. Fumigation of infested rooms with hydrocyanic acid gas or carbon disulphid is the most efficient method known for controlling both skippers and mites. . . . Fumigation should always be supplemented by a thorough cleaning of the infested rooms and the prompt disposal of all aged cheese. It is apparently unnecessary to remove cheese from a room during fumigation; the risk of scattering the infestation while transporting the stock to another room and the expense of handling may thus be avoided. Cheese of different types and ages showed no absorption of hydrocyanic acid gas or carbon disulphid. The odor which was apparent immediately after removal from the fumigating room disappeared after a short aeration. The cheese had no objectionable odor or flavor when eaten two hours later. Sulphur burned in the fumigating room gave a partial control of the mites but was of little value against the skipper."

A list of 11 references to the literature cited is included.

Animal parasites and human disease, A. C. CHANDLER (*New York: John Wiley & Sons, Inc., 1922, 2. ed., rev., pp. XIII+572, figs. 254*).—This is a second, revised edition of the work previously noted (*E. S. R.*, 39, p. 582).

Destroy the earwigs, B. B. FULTON (*Oregon Sta. Circ. 29 (1922), pp. 3, fig. 1*) -- A brief account is given of control measures for the European earwig, which has recently been introduced into Oregon.

Experiments on the infectivity of typhus virus contained in lice (*Pediculus humanus* and *Pedicinus longiceps*), F. E. ATKIN and A. BACOT (*Brit. Jour. Expt. Path., 3 (1922), No. 4, pp. 196-203, figs. 17*).—Details are presented of experiments conducted, in which *Macacus rhesus* was used.

Life history studies of some Florida aphids, A. C. MASON (*Fla. Ent., 5 (1922), No. 4, pp. 53-59, 62-65*).—In this paper the author reports studies of the biology and natural enemies of the green peach aphid, the melon aphid, and *Lachnus pini* L.

The gipsy moth on cranberry bogs, C. W. MINOTT (*U. S. Dept. Agr. Bul. 1093 (1922), pp. 19, pls. 6, figs. 4*).—This is a report of a study of the gipsy moth on cranberry bogs, commenced by the author in 1916. He finds that its infestation of cranberry bogs takes place principally through wind dispersion of first-stage larvae, and that this occurs only when conditions of wind velocity and temperature are favorable.

"The time when maximum dispersion prevails is usually not longer than from two to five days. Because of the activity of the young caterpillars in seeking food there are two daily periods of maximum dispersion, between 9 a. m. and 12 m. and between 2 and 5 p. m. Mortality of first-stage larvae is very great, large numbers perishing from low temperatures, unfavorable food, predacious insects, and disease. The embryos in all gipsy moth eggs deposited on cranberry bogs are killed by winter flowage, when the bogs are flowed from December 1 to May 1. Upon deciduous foliage in general the feeding of the first-stage larvae is upon the leaf hairs, but the injury to cranberry plants is caused by feeding upon the terminal buds, and later upon the new growth. As a rule, vines recover more quickly from injury upon wet bogs than upon dry ones. Flooding is the most effective method of control upon wet bogs, but spraying is the only method which can be employed on dry bogs. In order to

obtain the most satisfactory results, spraying should be done before wind dispersion begins."

The habits and distribution of some North Australian Culicidae, G. F. HILL (*Aust. Dept. Health, Serv. Pub. 21 (1922), pp. 32, pls. 8*).—Thirty-four species of mosquitoes are reported upon.

Mosquitoes and mosquito control, G. W. SIMONS, JR., and G. F. MOZNETTE (*Jacksonville: Fla. State Bd. Health, 1922, pp. 36, figs. 17*).—This is a discussion of the mosquitoes of health and economic importance in Florida, their habits, and means for control.

A revision of the Nearctic species of the tachinid genus *Ernestia* R. D. (Diptera), J. D. TOTHILL (*Canad. Ent., 53 (1921), Nos. 9, pp. 199-205, fig. 1; 10, pp. 226-230; 11, pp. 247-252; 12, pp. 270-274*).—Sixteen Nearctic species of this genus are recognized by the author, of which 11 are described as new. Among the species described as new is *E. johnsoni*, which was reared from the fall webworm and is recorded from eastern Massachusetts and at Fry Creek, B. C.

Some notes on Indian Calliphorinae, I-V, W. S. PATTON (*Indian Jour. Med. Research, 8 (1920), No. 1, pp. 17-29, pl. 1; 9 (1922), No. 3, pp. 548-574, pls. 4, figs. 2*).—The papers on this subject are as follows: *Chrysomya bezziana* Villen., the Common Indian Calliphorine Whose Larvae Cause Cutaneous Myiasis in Man and Animals (pp. 17-29); *Lucilia argyroccephala* Macq. (*Serenissima* Fab.), the Common Indian Bazaar Green Bottle, Whose Larvae Occasionally Cause Cutaneous Myiasis in Animals, and *L. cragga* n. sp., One of the Common Blow Flies of Indian Hill Stations (pp. 548-554); *C. megacephala* Fab. (Dux Esch), the Common Indian Blue Bottle, Whose Larvae Occasionally Cause Cutaneous Myiasis in Animals, and *C. nigriceps* n. sp., the Common Blue Bottle of the Nilgiris (pp. 555-560); *C. albiceps* Wied. (*rufifacies* Frog.), One of the Australian Sheep Maggot Flies, and *C. villeneuvei* n. sp. (pp. 561-569); and *L. pulchra* Wied. (*ruficornis* Macq.), a Larviparous Calliphorine, and *L. ballardi* n. sp., a Common South Indian Blow Fly (pp. 570-574).

Note on the value of a tame cow for collecting the bloodsucking Diptera of a locality, W. S. PATTON (*Indian Jour. Med. Research, 10 (1922), No. 1, pp. 66-68*).—The author presents this brief account with a view to drawing the attention of collectors to a simple method of obtaining the bloodsucking flies of a locality.

The white grubs of the sugar cane soils of Fiji, R. VEITCH (*Colon. Sugar Refining Co. [Sydney], Agr. Rpt. 5 (1922), pp. 14, pls. 4*).—This is an account of the three species of white grubs known to attack sugar cane in Fiji, namely, *Rhopaea testula* Arr., *R. subnitida* Arr., and *Adoretus versutus* Har.

The banana beetle borer, III, J. L. FROGGATT (*Queensland Agr. Jour., 18 (1922), No. 4, pp. 279-288, figs. 3*).—Further observations of *Cosmopolites sordidus* Germ. (E. S. R., 47, p. 259) are reported.

The red-necked sperry cane-borer, F. H. CHITTENDEN (*U. S. Dept. Agr., Farmers' Bul. 1286 (1922), pp. 11+5, figs. 5*).—This is a brief popular summary of information on *Agrilus ruficollis* Fab. and measures for its control.

The strawberry root weevil, A. FRANK (*Western Washington Sta. Bimo. Bul., 10 (1922), No. 4, pp. 81-86*).—This is a brief summary of information on the most serious pests of the strawberry in western Washington, namely, *Otiorhynchus oratus*, *O. sulcatus*, and *O. rugifrons*, where they are widespread. Brief reference is made to other insect enemies of the strawberry.

A preliminary report upon an improved method of controlling the boll weevil, G. D. SMITH (*Florida Sta. Bul. 165 (1922), pp. 72, figs. 13*).—In an introduction W. Newell reviews briefly the work that has led to the recommendation that an improved method of boll weevil control be made use of,

the details of which are presented by the author. In the first part of the account the author briefly reviews the efforts that have been made in the past to control the boll weevil, then reports at length upon the investigations with upland cotton conducted during the year in 20 fields in five towns, which have led to the recommendation of this improved method of control, much of the data relating to which are presented in tabular form.

It was known that a suitable application of lead or calcium arsenate made just before the squares appear kills practically all the weevils in the field, and that the last of the overwintering weevils emerge from hibernation several days after the cotton plants normally begin square formation, after which it is difficult to poison them. Observations of the emergence of boll weevils, previously reported (E. S. R., 45, p. 59), having shown that fully 99 per cent of the weevils are out of their winter quarters and in the cotton fields by June 5, the fields were stripped of all squares on that date. In this way all weevil eggs and larvae were disposed of and at the same time a large percentage of the adult weevils, since nearly all adults feed inside of the involucres of the squares. All the weevils not thus captured are forced to feed in the tender buds of the cotton plants, whereupon a single dust application of a suitable arsenical will destroy practically all of them.

While the removal of the squares from the plants early in June results in the absence of all squares for 5 to 7 days and of punctured squares for a considerable period, the data presented indicate that rapid growth took place for a few days following the removal of the squares, which in turn was followed by the appearance of squares from bottom to top. The stripping is followed by poisoning, and machines used to apply the poison must force it into the terminal buds because of the weevils' habit of feeding thereon. The removal of the squares results in a delay of 10 to 15 days in the opening of the cotton (or from July 30 to September 1) and permits harvesting with two or at most three pickings. It is stated that so pronounced has been the increase in the height of plants thus stripped, closely followed by a profuse fruiting, that it is highly probable that with no weevils present removal of all squares early in June would actually result in increasing the yield of cotton.

In summarizing all field experiments it was found the average production of seed cotton per acre on treated fields was 439 lbs., estimated at a value of \$35.42, and that the average cost of weevil control was \$1.57. The work indicates that it is possible for the Florida grower of upland cotton to insure for himself at least 90 per cent of a normal crop so far as weevil damage is concerned, and that this can be accomplished at a comparatively small expense. It is pointed out that while, for the present, the improved method is actually recommended for Florida only, there appears to be no reason, on theoretical grounds at least, why the method can not be successfully adapted to conditions existing elsewhere in the Cotton Belt.

Bees and beekeeping, scientific and practical, F. R. CHESHIRE (*London: Bazaar, Esch. and Mart Office*, [1921, 2. ed], vols. 1, pp. VII+336, pls. 8, figs. 71; 2, pp. VII+742, pl. 1, figs. 162).—This is a reprint of a work first issued in 1886, with the addition of an appendix to volume 2, by J. B. Lamb (pp. 641-724), which brings the work up to date. It is a complete treatise on the hive bee, the scientific part being presented in volume 1 and the practical in volume 2.

On the biology and economic significance of the chalcid parasites of Australian sheep maggot-flies, T. H. JOHNSTON and O. W. TIEGS (*Roy. Soc. Queensland Proc.*, 33 (1921), pp. 99-128, pls. 2, figs. 22).—Three new primary

hymenopterous parasites of sheep maggot-flies are recorded, namely, *Spalangia muscidarum* Richsn., *Paraspilomicrus froggatti* n. g. and n. sp., and *Australencyrtus giraulti* n. g. and n. sp., with observations of the life history of these and certain other parasites. A bibliography of 25 titles is appended.

Studies of some new and described Cynipidae (Hymenoptera), A. C. KINSEY (*Ind. Univ. Studies*, 9 (1922), No. 53, pp. 171).—This paper (pp. 3-141) presents descriptions of 107 American gall wasps, of which 70 are new, together with data on the variation, distribution, life histories, and phylogeny of gall wasps. A paper on Varieties of a Rose Gall Wasp (Cynipidae, Hymenoptera), by Kinsey and K. D. Ayres (pp. 142-162), follows.

Ants of the American Museum Kongo expedition: A contribution to the myrmecology of Africa, W. M. WHEELER ET AL. (*Bul. Amer. Mus. Nat. Hist.*, 45 (1922), pp. X+1139, pls. 45, figs. 150).—The several parts of this contribution deal with the subject as follows: On the Distribution of the Ants of the Ethiopian and Malagasy Regions (pp. 13-38) and The Ants Collected by the American Museum Kongo Expedition (pp. 39-270), both by Wheeler; The Predacious Enemies of Ants (pp. 271-332) and Ants in Their Diverse Relations to the Plant World (pp. 333-584) both by J. Bequaert; The Anatomy of Certain Plants from the Belgian Kongo, with Special Reference to Myrmecophytism, by I. W. Bailey (pp. 585-622); Notes on a Collection of West African Myrmecophiles, by W. M. Mann (pp. 623-630); Keys to the Genera and Subgenera of Ants (pp. 631-710), A Synonymic List of the Ants of the Ethiopian Region (pp. 711-1004), and A Synonymic List of the Ants of the Malagasy Region (pp. 1005-1055), all by Wheeler.

Red spider: A note on its control, T. PARKER (*Bur. Bio-Technol., Leeds, Bul. 5* (1922), pp. 143-149).—In experiments with the spider mite on carnation here reported, liver of sulphur and petroleum emulsion gave the best results in the dipping experiments, the red spider mites being killed without damaging the plants. A disadvantage is found, however, in the staining due to the depositions from the dipping solutions. Liver of sulphur and chlorocresols were quite effective.

"Fumigating with either the tetra- or pentachlorethane at the rate of 10 or 20 fluid ounces to 1,000 cu. ft. for 12 hours produces uncertain results without any deleterious effect upon the carnations. Nicotin petroleum emulsion, containing 2 per cent nicotin and 50 per cent petroleum oils, is quite effective in controlling the red spider on cucumbers provided that the sprayings are carried out at the dilutions suggested and in the manner prescribed."

A bulb pest (*Bur. Bio-Technol., Leeds, Bul. 5* (1922), pp. 150, 151, fig. 1).—In this brief account of *Rhizoglyphus echinopus* F. & R., it is pointed out that this bulb mite can be destroyed if, immediately after purchase and before being set, the bulb is treated with a solution of nicotin petroleum emulsion, 1 oz. to 1 gal. of water.

FOODS—HUMAN NUTRITION.

Research in physiological and food chemistry in the home economics laboratory, A. F. MORGAN (*Jour. Home Econ.*, 14 (1922), No. 10, pp. 486-493).—Home economics research in the United States is discussed, and problems suitable for research by home economics workers in physiological and food chemistry research are considered under the following headings: Variations in basal metabolism of women and children; changes in composition of the blood; studies of the origin and precursors of metabolic end-products in the urine and feces; determination of the gross digestibility and rate of digestion of foods; the chemical analysis of foods; the biological analysis of foods; and

studies on infant and child feeding. Under each heading the author cites papers by home economics workers which have already been published.

Some applications of our newer knowledge of nutrition, M. S. ROSE ([*Columbia Univ.*] *Teachers Col. Rec.*, 23 (1922), No. 1, pp. 34-51, figs. 5).—Conclusions drawn in this summary and discussion of research work follow:

"It may be said that our newer knowledge of nutrition should make us more appreciative of the fact that all dietary essentials—energy, protein, vitamins, mineral constituents—must be considered in relation to one another, none being able to function fully without the others in suitable proportions. We now have methods of demonstrating the contributions which individual foods can make to the diet as a whole, and have shifted our emphasis, giving a new prominence to milk and green vegetables which make good the defects of a cereal-meat-potato diet. And finally, we can demonstrate the far-reaching influence of a good or bad diet, not only upon individuals but upon the stamina which they may impart to their descendants."

A bibliography is appended.

The value of whale meat as human food, A. F. MORGAN and E. L. BROWN (*Jour. Home Econ.*, 14 (1922), No. 6, pp. 267-270).—Frozen whale meat was procured for the experimental work reported, and, according to the authors' analysis, freshly thawed whale flesh contained water 56.9, protein 25.3, fat 17.4, and ash 0.37 per cent, the undetermined matter being 0.02 per cent. The total nitrogen was found to be 3.43, nitrogen insoluble in cold water 2.5, coagulable nitrogen 0.35, and meat bases 0.58 per cent. With the two young women who served as subjects, the coefficients of absorption of nitrogen were found to be 96.8 and 71.9 per cent, in comparison with 99 and 98.7 per cent for beef. The results obtained in this first trial indicate the probability of easy and complete digestion of whale flesh.

Nitrogen balances were calculated each day during the experiment, and with both subjects nitrogen equilibrium was attained upon amounts of the whale nitrogen as low as 0.047 and 0.097 gm. per kilogram of body weight. These figures compare well with those obtained in similar experiments with beef and other well-known protein foods.

Some experiments on the digestibility of rolled oats prepared in various ways, M. S. ROSE (*Jour. Home Econ.*, 14 (1922), No. 1, pp. 9-14).—Experiments are reported with women as subjects to determine the digestibility of rolled oats prepared in different ways and eaten as a part of a simple mixed diet. The average results follow:

Results of digestibility experiments with diets containing rolled oats prepared in various ways.

Method of preparation of rolled oats.	Coefficient of digestibility.	
	Protein.	Carbohydrate.
	Per cent.	Per cent.
Mush cooked overnight in fireless cooker	93.9	99.6
Do.	94.8	99.8
Mush boiled 10 minutes.	91.9	99.5
Do.	91.2	99.6
Wafers, commercial.	87.8	99.9
Wafers, homemade.	83.9	99.0
Muffins.	87.6	99.6
Macaroons with corn syrup	91.1	99.2
Do.	92.7	99.9
Do.	91.3	99.8
Macaroons with sugar.	90.6	99.3
Do.	91.8	100.0

According to the author's summary, "in so far as nonappearance in the feces can be taken as a criterion, rolled oats is a very digestible food, whether cooked a long or a short time in the home. The rolled oats used was loose rolled oats, bought at a large market, and not a fancy, specially prepared product. Differences in preparation affect the apparent utilization of protein more than of carbohydrate. The protein of oatmeal wafers was less well utilized than that of oatmeal macaroons. This might possibly be explained by the greater amount of mastication induced by the macaroons. Differences in length of time in cooking oatmeal mush affect rate rather than completeness of digestion, and also affect palatability as influenced by flavor and texture."

Fats and their use in pastry making, M. C. TATUM (*Jour. Home Econ.*, 14 (1922), No. 7, p. 330).—Conclusions drawn from a study of fats for pastry making follows:

Good plain pastry may be made from the common fats in proportions ranging from one part of butter and four parts of flour to one part of oil and seven parts of flour by weight. Fat and water do not have to be ice cold when making plain pastry. Much handling makes tough pastry. Butter, oleomargarin, and certain vegetable fat preparations make excellent puff paste, and the best proportion is one part of fat to one part of flour by weight, or one part or fat to two parts of flour by measure.

The following methods aid, in a measure, to prevent fruit juices from soaking into the lower crust of fruit pies. One half to one tablespoon of flour cooked into the fruit juice before the pie is made, flour sprinkled over the lower crust, cooking the crust in a granite pan on the lower rack of the oven at 300° C. for seven minutes, and brushing the lower crust with egg white. The extent to which the lower crust increased in weight as a result of the baking process served as a measure of the amount of absorption which had taken place.

Molds in cold storage meat, BIDAULT (*Bul. Soc. Sci. Hyg. Aliment.*, 10 (1922), No. 1, pp. 12-25).—With the use of an agar medium consisting of 2.5 parts of peptone, 500 of carrot bouillon, and 15 of agar, the author has isolated from cold-storage meat the following molds arranged in order of decreasing frequency: *Choetostylum fresenii*, *Thamnidium elegans*, *Penicillium crustaceum*, *Hormodendron cladosporoides*, *Cladosporium herbarum*, *Stysanus stimonites*, *Botrytis elegans* and other species of *Botrytis*, and several yeasts. From cold-storage meat which had been thawed in a dry atmosphere and kept for several days at a temperature of about 15° C. (59° F.) several varieties of *Mucor* have been isolated.

The relative occurrence and most interesting biological characteristics of these molds are described, and methods aiming at the prevention and treatment of such contamination of meat in cold storage are discussed. Lower temperatures of refrigeration and care in keeping the air in the cold-storage warehouses as dry as possible are recommended as the best means of dealing with this problem.

Nutrition in sports, J. P. LANGLOIS (*Bul. Soc. Sci. Hyg. Aliment.*, 10 (1922), No. 2, pp. 71-87, figs. 4).—A general discussion of nutritive requirements for those indulging in various forms of sports.

[**Catering to the University of Chicago Commons**] (*Hotel Mo.*, 30 (1922), No. 354, pp. 29-53, figs. 47).—A descriptive account of methods followed in the preparation and service of foods in dining rooms under the supervision of the university, as well as the equipment, kitchen, system of meal accounting, and other similar matters. Samples of the forms used for accounting are given.

The rural school lunch to-day, L. MILAM (*Jour. Home Econ.*, 14 (1922), No. 3, pp. 128-131).—Facts collected regarding the present status of hot lunches in rural schools in the United States are summarized and discussed. It is stated that 8 States have hot-lunch clubs, 17 States use graphic posters, and 21 States issue bulletins or other material through the State extension department, the department of education, or the department of public health.

The great need for information on racial dietary customs, L. H. GILLET (*Jour. Home Econ.*, 14 (1922), No. 6, pp. 258-261).—The results of four papers are here summarized and discussed, as follows: Jewish Diets, by M. Schapiro; Italian Dietary Customs, by R. Reed; Lithuanian Diet, by M. Newell; and Mountain White and Negro Dietary Habits, by F. Proudfit. As is pointed out in the discussion of the work, a study of the habits of the various races emphasize the importance of attention to the diet of the pre-school child.

The opinion is expressed that "the teaching of nutrition should be begun for the child before he is of school age," and that "for the time being social agencies can not escape their responsibility in the question of the nutrition of the children."

Methods of vitamin investigations, E. W. MILLER (*Jour. Home Econ.*, 14 (1922), No. 8, pp. 364-368).—This discussion of factors which must be taken into account if significant results are to be obtained in vitamin discussions includes the biological reagent, i. e., a plant or animal that will serve as a suitable reagent, the control diet, the artificial diet, the preparation of vitamin material, the administration of vitamin, the amount of food consumed, the importance of hygiene, the duration of the experiment, and specific deficiency effects.

The biological analysis of milk from the point of view of vitamins, H. SIMONNET (*Bul. Soc. Sci. Hyg. Aliment.*, 10 (1922), No. 3, pp. 125-178, figs. 23).—This is a very complete review of the literature on the value of milk as a source of vitamins and on the variations on the vitamin content of milk, depending upon the food of the lactating animal and the treatment which milk undergoes before consumption. Under this head are considered skim milk, butter, and pasteurized, boiled, condensed, and dried milk. The subject matter is illustrated throughout with growth curves from the original publications reviewed, and an extensive list of literature references is appended.

Composition and nutritive value of yeast grown in vitamin-free media, J. E. DARBAH (*Amer. Food Jour.*, 17 (1922), No. 8, p. 19).—A brief summary is given of some experimental work in which rats were used as subjects. The author sums up the work as follows:

"Yeast may be grown in vitamin-free media through an exceedingly large number of transfers. Yeast grown in this way contains protein and nitrogenous bases of undoubted nutritive value. Evidence of dietetic value due to vitamin content of yeast ipse facto is not substantiated. Yeast does not appear to be an active synthesizer of vitamins from other materials. There was only slight indication of the presence of vitamin B and none of vitamins B and C in yeast grown in vitamin-free [media]."

The author also discusses experiments which have to do with the local Florida diet. As she points out, "one of the chief sources of deficiency in the dietary of this section is the rather limited quantity of milk consumed. This applies more especially to certain rural communities."

The good results which obtained when milk was added to such a diet were shown by experiments with rats. The animals used in such experiments were sent to county and State fairs for exhibition in nutrition booths; they were also used to illustrate lectures to groups of school children. Such work aroused considerable interest in the topic of milk consumption.

Primary changes in eyes of rats which result from deficiency of fat-soluble A in diet. S. MORI (*Jour. Amer. Med. Assoc.*, 79 (1922), No. 3, pp. 197-200, figs. 7).—With a view to clearing up the confusion concerning the exact nature of the eye disease resulting from lack of vitamin A and which has been variously termed xerophthalmia and keratomalacia, the author has made a study of the early changes in the corneal and conjunctival epithellum of rats in various stages of the disease. The microscopical examination of the eye sections showed that the first changes to be noticed at the onset of the disease are two which are due to dryness of the conjunctiva. "One of these is the cornification of the outer layer of epithelial cells of the conjunctiva bulbi, and the other the formation of granules of keratohyalin in the cytoplasm of the second layer of these cells." These changes are the characteristic changes of the xerosis conjunctivae of human beings. The conjunctival condition is followed by a similar condition of the cornea, xerosis corneae or xerophthalmia. "Xerosis is the essential change and is caused only by the dryness of the tissue. The ulcers of the cornea (keratomalacia) are secondary and are due to secondary infection by microorganisms."

The changes in the para-ocular glands which follow the administration of diets low in fat-soluble A, with notes of the effect of the same diets on the salivary glands and the mucosa of the larynx and trachea. S. MORI (*Bul. Johns Hopkins Hosp.*, 33 (1922), No. 380, pp. 357-359, pls. 2).—In an effort to explain the cause of the changes in the conjunctival epithellum of rats suffering from xerophthalmia, as noted above, the author has studied histologically the para-ocular glands of rats in various stages of xerophthalmia, and has also made a similar study of the salivary glands and the mucous membranes of the larynx and trachea.

The most striking changes in the tissue of the lacrimal glands was a shrinkage and degeneration of the secretory cells, thus indicating failure of lacrimal secretion. This is thought to explain the dryness of the eyeballs and the xerosis of the cornea and conjunctiva, as well as the increase in the number of organisms found in the conjunctival sac. The findings in the salivary glands were similar to those occurring in the lacrimal glands, these also showing a lack of secretion, resulting in the drying of the mucous membrane. Still more striking changes were evident in the mucosa of the larynx and trachea, which showed extensive xerotic changes. This dryness is considered to be the cause of the inflammatory changes and bronchopneumonia often occurring in rats on diets deficient in vitamin A. On the addition of 2 per cent of cod-liver oil to the diet, the various glands recovered their secretory power and the pathological changes disappeared.

The author concludes that vitamin A acts either directly or indirectly on certain of the secreting glands in the body, thus insuring their normal function. "In other words, xerophthalmia, as it is ordinarily seen, is the manifestation of a specific glandular lesion. It is one of a chain of symptoms, the other links of which are hoarseness, cough, lack of saliva, sterility, and general malnutrition."

The intestinal bacterial flora of rats on a diet deficient in fat-soluble vitamin A. F. CREEKMUR (*Jour. Infect. Diseases*, 31 (1922), No. 5, pp. 461-467).—A comparative study is reported of the bacterial flora of rats on a normal diet and on a diet deficient in vitamin A.

No significant difference could be noted in the relative importance of Gram-negative and Gram-positive rods and cocci. In most of the animals on the deficient diet streptococci disappeared completely. There seemed to be no change in the proportions of bacteria fermenting glucose, lactose, and sucrose

or in the proportion of hydrogen sulphid-forming bacteria. It was noted, however, that on the deficient diet the feces of most of the animals became dry and hard, and the total number of bacteria was greatly decreased. Following the addition of vitamin A in the form of a few drops of cod liver oil daily, the feces became moist and soft, and the total number of bacteria increased.

New viewpoints on the vitamin question, F. GROEBBELS (*Klin. Wchnschr.*, 1 (1922), No. 31, pp. 1548-1551, fig. 1).—A brief report is given of experiments conducted on white mice to determine the effect of lack of vitamin B on weight, oxygen consumption, behavior, and length of life. For purposes of comparison three groups of animals were used. The first group was fed oats, the second was given no food, and the third was fed polished rice until death.

In the first group of 7 animals the oxygen consumption, as determined in Kestner's respiration apparatus for small animals, showed maximum differences of not more than 10 per cent. The second group of 4 showed in 24 hours a loss of weight amounting to 13.1 per cent and a decrease in absolute oxygen consumption of about 31.1 per cent. One of these animals was continued without food until death, which took place in 4 days after a loss in weight of 27 per cent and in absolute oxygen consumption of 38 per cent. The other animals, which were given oats after 24 hours, recovered their weight and returned to normal oxygen consumption in 2 days.

The third group consisted of 14 mice of various ages. When fed polished rice instead of oats they showed a maximum loss in weight until the time of death of 44 per cent, although the loss in weight in most cases was about 32 per cent. No direct relation could be observed between loss in weight and length of life. The curves representing absolute oxygen consumption showed, first, an increase in consumption of from 24 to 59 per cent, followed by a constant decrease. The second part of the curves showed marked resemblance to the inanition curves. The decrease began earlier with the younger animals than with the older. The symptoms observed were similar to those reported in the literature. The animals appeared in good condition until a few days before death, when they appeared to lose muscular control. On autopsy the intestines were invariably found to be full of material. Life was prolonged by the administration of pure oxygen.

In discussing these results, the author suggests that the early increase in oxygen consumption can be more definitely attributed to lack of vitamins than the later decrease. Assuming that the vitamins are oxygen-regulating substances, it is thought that the increased oxygen consumption at the beginning of the vitamin-free feeding can be explained either by the suppression of an inhibitory substance or the suppression of the toxic action of nonoxidized by-products. The subsequent lowering of tissue metabolism is considered to be the result of the lowering of protein and mineral metabolism resulting from the lack of vitamins.

The potency of some commercial vitamin preparations as compared with that of dry brewers' yeast, E. M. BAILEY (*Connecticut State Sta. Bul.* 240 (1922), pp. 3-51, figs. 21).—In the extensive examination by the author, with the collaboration of H. C. Cannon and H. J. Fisher, of commercial vitamin products, the results of which are reported in this publication, the standard selected for comparison was 100 mg. of dry brewers' yeast serving as the sole source of vitamin B in an otherwise complete diet for young rats. Three separate series of tests were made. In one, 100 mg. of the dry material or an equivalent amount of moist material was fed daily. In the second series the sexes were reversed and the material was fed in the same amount, or if it had

produced normal growth in the first experiment the amount was reduced to 50 mg. daily. In the third series a fresh sample of the material was used in either 50 or 100 mg. doses, depending upon the results of the first two series. In each case the animal was kept upon the basal diet alone until it declined in weight, when the trial unit quantity was given apart from the basal diet. If improvement was noted the feeding of the preparation was continued until the animal acquired its normal weight. If there was continued loss in weight the commercial preparation was withdrawn and dry yeast was fed for a sufficiently long period to show that the animal possessed recuperative powers. Partial chemical examinations were also made of the substances investigated, including determinations of moisture, ash, total nitrogen, and water-soluble and water-insoluble nitrogen.

Of the 21 products examined, Yeast Vitamine-Harris tablets, Yeast Vitamine-Harris powder, and Vegex proved as satisfactory as the brewers' yeast control. With all of these preparations satisfactory growth was also secured when the amount was reduced to 50 mg. daily and with Yeast Vitamine-Harris powder to 25 mg. With the 100-mg. doses growth closely approximating the control was secured with Cerevisine, Yeast Foam tablets, Merck's Medicinal Yeast, and Metagen. Maintenance or indifferent or inconsistent growth resulted from Vita Zest, Fleischmann's yeast, Yeastamine, Vitamon, and Ironized Yeast. The other products, Magic Yeast, Medic Yeest, Phos-pho Vitamine, Phytamin, Vi-ta-co, Yeastone, Yeastonic, and Yeast Vitamine, Nuxated Brand, all showed no value as a source of vitamin B.

The chemical analyses indicated that in many cases the yeast or other vitamin B-containing substance had been largely diluted by the addition of various medicaments. "Apparently many manufacturers are not entirely convinced of the efficacy of their vitamin preparations unassisted and have, therefore, added various medicaments of established reputation in therapeutics for good measure or to insure a reaction of some description."

Acute and latent avitaminoses, H. SIMONNET (*Bul. Soc. Sci. Hyg. Aliment.*, 10 (1922), No. 1, pp. 26-39, figs. 10).—Essentially a review of the series of papers by McCollum et al. on supplementary protein values in foods (*E. S. R.*, 46, p. 161).

Beriberi in the garrison at San Juan, Porto Rico, B. K. ASHFORD (*Amer. Jour. Trop. Med.*, 2 (1922), No. 4, pp. 305-340).—The author reports in considerable detail an investigation of a number of cases of beriberi occurring in the army garrison at San Juan, Porto Rico, from 1919 to 1921. The investigation included an examination of the dietary of the troops from the point of view of deficiency in antineuritic vitamin and other factors, a study of the symptoms as reported in 12 case records, the autopsy of one fatal case, and an inspection of the general hygiene and sanitary condition of the post.

From the various observations reported the conclusion was drawn that the pathological condition was a form of beriberi complicated by glandular deficiency induced by protein deficiency in the food. While the ration as served furnished a sufficiency of antineuritic vitamin, it contained too high a proportion of rice and fat and too little fresh meat and vegetables. Moreover, the natural food habits of the native soldiers led them to eat inordinate quantities of the polished rice, which made up the bulk of the carbohydrate of the ration. It is recommended that all rice issued to the Porto Rican troops be undermilled and that lectures be given officers and men on the danger of eating too little meat and an excess of carbohydrates. It is also suggested that the supply of vegetables be increased by the introduction of vegetable gardens at the garrison.

A study of some of the digestive functions of normal, starving, and polyneuritic pigeons, DANYSZ-MICHEL and W. KOSKOWSKI (*Compt. Rend. Acad. Sci. [Paris]*, 175 (1922), No. 1, pp. 54-56).—The authors report an examination of the gastric juice of normal and starving pigeons and of pigeons fed polished rice with and without daily injections of histamin in physiological salt solution. The secretion of gastric juice in each case was excited by the injection of feeble doses of histamin, and determinations were then made of the total quantity and H-ion concentration of the juice and of its content in pepsin.

Practically the same quantity of gastric juice, from 6 to 7 cc. in an hour, was secreted under identical conditions by all the pigeons except those receiving polished rice alone, the amount obtained in this case being from 1 to 4 cc. in an hour. The acidity, as calculated by electrometric H-ion concentration determinations, was higher in the case of pigeons fed polished rice and receiving additional injections of histamin than in normal pigeons and less in starving and polyneuritic pigeons. Pepsin activity was absent in the gastric juice of the pigeons fed polished rice alone, weak in starving pigeons, and more pronounced in pigeons fed polished rice and receiving histamin. The bacterial flora of both groups of pigeons receiving polished rice was more abundant than in normal or starving pigeons and was of pronounced proteolytic power.

It is concluded that the digestive disturbances in pigeons on a polished rice diet are due to the lack of secretion of pepsin in the gastric juice.

What is botulism? (*Table and Housekeepers' Jour.*, 71 (1922), No. 1830, p. 152).—A summary containing data on an outbreak at Loch Maree, Scotland.

ANIMAL PRODUCTION.

The effects of inbreeding and crossbreeding on guinea pigs, I, II, S. WRIGHT (*U. S. Dept. Agr. Bul.* 1090 (1922), pp. 63, pls. 6, figs. 11).—Data collected from inbreeding 23 families of guinea pigs from 1906 to 1920 were studied and reported in two parts.

I. Decline in vigor (pp. 1-36).—Guinea pigs which were inbred for 13 years by brother and sister matings were compared as to vigor with controls in which matings of animals more closely related than second cousins were avoided. The characters studied to determine vigor were fertility, mortality, rate of growth, and susceptibility to tuberculosis. The vigor of the controls and the inbred stock, as determined by these characters, fluctuated from year to year, but the inbred animals gradually became inferior to the controls in nearly all of the characters. Disregarding the fluctuations from year to year and fitting the results to a yearly straight line change by the use of Pearson's method of movements for each character for the years 1907 to 1915, the decline in vigor which occurred is more definitely brought out. The following values were obtained by the method for the characteristics in any year in which x equals the number of years after 1906: Size of litter $2.885 - 0.043x$, litters per year $4.210 - 0.110x$, young per year $12.092 - 0.450x$, percentage born alive $88.27 - 0.29x$, percentage raised of those born alive $92.10 - 1.04x$, percentage raised of all born $81.30 - 1.16x$, birth weight of young raised (grams) $86.17 - 0.19x$, gain from 0 to 33 days (grams) $163.70 - 1.96x$, and weight at 33 days (grams) $249.87 - 2.15x$.

Just previous to 1915 several of the inbred families became extinct and several of the other families were discarded after 1915, so that only 5 families remained for the studies up to 1920. The control animals in the experiments showed some decline in vigor during the test, but this decline was attributed to

the environmental conditions and was not as great as the decline in vigor shown by the inbred animals. The most marked decline by the inbreds was in the frequency and size of litters. The ability to grow normally and keep alive after birth showed a greater decline than the birth weights of the young or the percentage of young born alive, and the ability to raise large litters showed a greater decline than the ability to raise small litters. In studying the resistance to tuberculosis it was found that a greater percentage of the control stock died from generalized tuberculosis, but this was found to be due to the fact that many of the inbred animals died from other causes before tuberculosis had an opportunity to cause their death. The average length of life after inoculation was also less in the case of the inbred stock. The sex ratio was not affected by inbreeding.

II. *Differentiation among inbred families* (pp. 37-63).—A study of the individual inbred families showed that the characteristics studied had a tendency to be fixed in each family by successive generations of inbreeding. Variations in color and pattern of coats which have previously appeared to follow a blending mode of inheritance became so well fixed that it was possible to determine the family to which individuals belonged by their appearance. Certain of the families were found to be much more vigorous than others, and the characters determining vigor became more firmly established in the succeeding generations. This fact is brought out by a comparison between the ranking of the families for the different characters in periods from 1906 to 1910, 1911 to 1915, and 1916 to 1919. A very close correlation was obtained between the ranking during the last two periods (only 5 families available 1906 to 1919), whereas the rankings during the first two periods were often not in agreement. One family which ranked low during the first period in size of litter, litters per year, young per year, percentage raised, birth weight, gain to 33 days of age, and weight at 33 days of age ranked high or very high in these characteristics during the second and third periods. This change is explained as being due to a fortunate combination of genetic factors which segregated in one subgroup of this family so that it finally dominated the entire family. However, in general the correlations between the relative ranking of the families during different generations were high, really higher than the calculations showed, because of a marked change in ranking of two or three families by the dominance of a subgroup within those families.

"The study brought out a striking contrast between the effects on vigor of hereditary and environmental factors. Favorable or unfavorable conditions affect alike growth, mortality among the young, and fertility, in all their aspects. On the other hand, hereditary factors which affect each character by itself appear to be much more important than ones which affect general vigor."

Monstrosities developed in some of the families of both the inbred and control stock, but more occurred in the inbred stock. This was because inbreeding brings out variations that depend on recessive factors, and thus there was a tendency for certain families to produce monstrosities. More monstrosities happened to occur among some of the more vigorous families.

An hereditary notch in the ears of Jersey cattle, J. L. LUSH (*Jour. Heredity*, 13 (1922), No. 1, pp. 8-13, figs. 9).—The method of inheritance of a notch in the ear of Gamboge's Raleigh 109548, the principal Jersey sire at the Texas Agricultural College, is described. Of the 30 calves of this sire examined, 18 were found to have this character. Proof is offered to bear out the hypothesis that this characteristic in the bull is due to a single dominant nonsex-linked factor. The only evidence against this hypothesis is the statement of a breeder

that a son of this bull not showing the notch sired a calf with the notch in the ears.

Regression equations of numerical characters according to Pearson's well-known correlation theory, G. DUNCKER (*Biol. Zentbl.*, 42 (1922), No. 6, pp. 253-270, figs. 2).—This paper briefly explains the formulas for calculating correlation and probable error according to Pearson, and then points out certain irregularities in the regression which occurs in three different sets of tables used as examples.

The study of heredity, V. HAECKER (*Allgemeine Vererbungslehre*. Brunswick: Friedr. Vieweg & Son, 1921, 3. ed., rev. and enl., pp. XI+444, pl. 1, figs. 149).—This is a revised edition of the book previously noted (E. S. R., 25, p. 771), with the addition of chapters on the practical use of the results of recent investigations and a discussion of the development of the analysis of characters.

The action of hypophysin, ergamin, and adrenalin upon the secretion of the mammary gland, E. ROTHLIN, R. H. A. PLIMMER, and A. D. HUSBAND (*Biochem. Jour.*, 16 (1922), No. 1, pp. 3-10).—As a result of experiments in injecting two goats at different stages of lactation with hypophysin, adrenalin, and ergamin, the results previously noted by Hammond (E. S. R., 31, p. 272) and Hammond and Hawk (E. S. R., 37, p. 272) were confirmed and extended. Hypophysin was found to have an immediate action in the early stages of lactation by increasing the milk flow, which was counteracted at the next milking by a reduction in flow. Adrenalin and ergamin seemed to have no influence on the secretory activity of the mammary gland.

White artichoke, a delicious food, I, II, J. C. SIBLEY (*Jersey Bul. and Dairy World*, 41 (1922), Nos. 31, pp. 1787, 1788, 1832-1835; 32, pp. 1855, 1870, 1871).—This is a discussion of Mammoth French White artichokes as a feed for live stock. The author has found that the tubers and stalks of this artichoke are very palatable, especially to horses, sheep, and swine. Hay and silage have also been satisfactorily produced from it. The analysis of the stalk and a brief review of the literature on this subject are also given.

Silage experiments, 1920, [at the Dickinson Substation], L. MOOMAW (*North Dakota Sta. Bul.* 160 (1922), pp. 25, 26).—Silage made of Russian thistles, flint corn, Mammoth Russian sunflowers, and wild sunflowers and packed into barrels which were reheaded apparently kept well for about 10 weeks, when the silage was tested. The thistle silage was eaten readily by some animals, but sparingly by others. Silage made of thistles and oat straw, while having an offensive odor, was slightly more palatable, but wild sunflower silage was less palatable than the thistle silage.

Investigations of the feeding value of straw hydrolyzed by various processes.—IV, **Treating straw with caustic soda under pressure**, F. HONCAMP, O. NOLTE, and E. POMMER (*Landw. Vers. Sta.*, 98 (1921), No. 5-6, pp. 249-263).—In continuing experiments to determine the manner in which caustic soda modified the digestibility and nutrients in straw (E. S. R., 47, p. 274), similar experiments are reported in which rye, barley, oat, pea, turnip, and rape straws were mixed, chopped, and treated with 3.5 and 7 per cent caustic soda for about four hours under from 5 to 6 atmospheres' pressure in most cases. With the 7 per cent sodium hydroxid treatment the straw was washed after treatment to remove the excess sodium hydroxid, but the straw treated with 3.5 per cent caustic soda was not washed after treating.

Chemical analyses were made of the untreated and treated straws for dry matter, organic matter, crude protein, pure protein, nitrogen-free extract, crude fat, crude fiber, ash, lignin, cellulose, pentosan, and starch value, the amount of change in the composition and energy value of the straw during

the treatments thus being determined. The coefficients of digestibility were calculated in digestion trials with two wethers, as in previous experiments, and the changes in digestibility due to treating the straws were also calculated. In all treatments there was found to be more or less destruction of organic matter, which was reflected as a reduction of the percentage composition of all groups of nutrients except the crude fiber which thus appeared to be increased, though the total amount present was the same or perhaps slightly less.

With the 3.5 per cent treatment there was found to be a loss of approximately 10 per cent of the organic matter. As would be expected, the loss in organic matter was much greater (about 30 per cent for cereal straws) where the straw was washed after the 7 per cent treatment and thus a larger portion of the water-soluble material removed than by simple draining. There was found to be considerable variation in the loss of nutrients by the different straws, a greater loss occurring in the case of the cereal straws, due to the fact that they were more easily decomposed.

It is concluded that the cereal straws are best adapted to hydrolysis with sodium hydroxid and that the treatment with 3.5 per cent caustic soda is as effective as the stronger treatment, since in the latter case such large amounts of nutrients except fiber seemed to be lost in the rinsing water. Studies of the action of soda on straw showed that the cellulose and pentosan were rendered more available by the treatments, which thus may help increase the feeding value of treated straw.

Proceedings of the twenty-fifth annual convention of the American National Live Stock Association (*Amer. Natl. Live Stock Assoc. Proc.*, 25 (1922), pp. 190, pls. 7).—This is the usual report of the annual meeting of this association held at Colorado Springs, Colo., January 12-14, 1922 (E. S. R., 46, p. 872).

Utility value of purebred live stock, D. S. BURCH (*U. S. Dept. Agr., Dept. Circ.* 235 [1922], pp. 22, figs. 13).—Information collected from 525 farmers who have kept purebred sires for an average of 9 years has been summarized and reported. Over 90 per cent of these farmers were satisfied with purebred live stock, it being reported that the utility value of purebreds was an average of 40.4 per cent greater than the utility value of scrubs. Other points in which purebreds excelled scrubs were in superiority and uniformity in conformation and type, greater sale value, early maturity, and economy of production.

The live stock industry in South America, L. B. BURK and E. Z. RUSSELL (*U. S. Dept. Agr., Dept. Circ.* 228 (1922), pp. 36, figs. 24).—This is a description of the live stock industry in Argentina, Uruguay, Brazil, and Chile. Special reference is made to the possibilities of stimulating trade in live stock between each of these countries and the United States. The most nearly universal difficulty at present seems to be the rate of exchange.

The utility of yucca and chamiza as range supplements, L. S. BROWN (*New Mexico Sta. Bul.* 133 (1922), pp. 38, figs. 7).—In continuation of the studies of the nutritional value of yucca and chamiza previously noted (E. S. R., 46, p. 365), two studies are reported on the feeding value and digestibility of the soapweed (*Yucca elata*) as determined by range cows, and the digestibility of chamiza (*Atriplex canescens*) as determined by steers.

In testing the feeding value of the yucca, 10 mature bred cows were divided into two lots which were fed on yucca alone and yucca and cottonseed meal, respectively, for 120 days. During the first two months a maintenance ration only was fed, but during the third and fourth month a full feed was allowed. The 5 cows receiving cottonseed meal (fed at the rate of 0.454 kg. (1 lb.) per

day throughout the test) while on the maintenance ration consumed from 9.1 to 12.5 kg. of yucca per day, making gains in live weight of 41, -23, -102, -133, and +24 lbs., and while on full feed these cows consumed from 11.1 to 15.3 kg. of yucca per day, making gains of 64, 60, 62, 63, and -17 lbs. The 5 cows on yucca alone during the maintenance period consumed from 9.6 to 11.3 kg. per day, making gains of 3, -30, 7, 5, and -35 lbs. When on a full feed of yucca these cows consumed from 10.3 to 11.9 kg. per day, making gains of 15, 13, -10, 10, and 36 lbs. during the period. During the first two months of the test 2 of the cows calved. This accounts for the heavy losses of 102 and 133 lbs. by cows in the group receiving cottonseed meal. Based on the weight of calves and afterbirth, these corrected losses were calculated to be 31 and 41 lbs., respectively. One of the calves born died at 2 days of age, but the other was raised normally, and the loss of the one calf is not attributed to the yucca feeding. The other cows calved normally after the conclusion of the test.

Digestion trials were carried on with 4 cows for 10 days at the end of the 2 months' maintenance period and at the end of the feeding period. The 2 cows on the digestion trial with yucca alone consumed an average of 10.5 kg. per day while on the maintenance ration and 12.5 kg. per day on full feed. The 2 cows receiving the protein supplement consumed an average of 0.454 kg. of cottonseed meal per day during both trials, as well as 11 kg. of yucca during the first trial and 12.75 kg. per day during the second trial.

The digestion trials with chamiza (hand-picked leaves) were carried on with 4 steers for a period of 14 days, the last 6 days' results of which were used in calculating the digestibility of the feeds, since a more uniform consumption of the chamiza occurred during that period. The 2 steers receiving a ration of chamiza alone each consumed an average of 6.5 kg. per day, whereas one of the steers receiving the protein supplement consumed 8.2 kg. of chamiza and 1.4 kg. of cottonseed meal as compared with 7.6 kg. of chamiza and 0.3 kg. of cottonseed meal consumed by the other steer. The following table gives the average coefficients of digestibility and nitrogen balances determined for the yucca and chamiza alone and in mixtures with cottonseed meal. The digestibility given for the mixture of chamiza and cottonseed meal is only for the steer showing the better appetite.

Digestibility and nitrogen balances with yucca and chamiza.

Kind of feed.	Period.	Average coefficients of digestibility.							Nitrogen balance per day.
		Organic matter.	Dry matter.	Protein.	Fat.	Fiber.	N-free extract.	Ash.	
Yucca and cottonseed meal.	First.....	Per ct. 54.51	Per ct. 50.94	Per ct. 43.80	Per ct. 17.54	Per ct. 30.71	Per ct. 71.37	Per ct. 6.20	Grams. +17.04
Do.	Second.....	61.28	59.09	52.26	31.55	39.78	76.21	31.57	+23.79
Yucca alone.....	First.....	57.67	54.05	23.96	.....	38.67	73.37	9.54	+9.81
Do.	Second.....	54.36	51.71	32.12	.....	30.30	72.53	19.06	+13.36
Chamiza and cottonseed meal.	(1)	68.52	69.14	81.43	53.79	15.20	78.84	71.40	+56.32
Chamiza alone.....	.....	52.69	54.32	64.20	.....	14.26	62.09	59.11	-10.88

¹ Results for one steer.

It is noted that the fiber and nitrogen-free extract are the only nutrients of any considerable value in the yucca, but all nutrients in the chamiza occur in sufficient quantities to give dependable results, though those of most value are probably the protein, nitrogen-free extract, and mineral matter. From the

results of the test it appears that cattle may be maintained on yucca or chamiza alone, but the deficiencies of either feed make for an inefficient utilization of the nutrients. Maintenance on chamiza alone for long periods, however, may result in weakened eliminative system or impaired capacity for the healthy storage of food elements. It is recommended that chamiza be fed with corn stover or other roughage high in carbohydrates and fiber.

[**Silage from corn stover and from normal corn for steers**], G. A. BROWN (*Mighty Sta. Rpt. 1921, p. 156*).—Three lots of steers fed rations of normal corn silage, stover silage, and stover silage plus an amount of corn equal to that removed from the stover made average daily gains of 1.94, 1.42, and 1.58 lbs. per head. The cost was also less in the case of the first lot.

Sheep feeding investigations, 1920-21, A. M. PATTERSON and H. B. WINCHESTER (*Kansas Sta. Circ. 96 (1922), pp. 7, fig. 1*).—In continuation of the sheep feeding investigations previously noted (*E. S. R.*, 45, p. 574), three lots of 32 wethers each and four lots of 33 lambs each were fed during the winter of 1920-21. The feeding periods were 40 days for the wethers and 79 days for the lambs. The rations for the wethers consisted of alfalfa hay, cane silage, and salt in all lots, with the addition of cottonseed meal treated with calcium chlorid in one lot and untreated cottonseed meal in the other lots. The lot receiving treated cottonseed meal also received white shelled corn, as well as one of the other lots. The third lot received yellow shelled corn and made the best average daily gain of the three lots, which was 0.36 lb. per wether. The lot receiving white corn and untreated cottonseed meal made average daily gains of 0.29 lb., and the lot receiving white corn and treated cottonseed meal 0.3 lb. It required 113 lbs. more white shelled corn to produce 100 lbs. of gain than were required by the yellow corn ration.

The rations for the lambs consisted of shelled corn, cane silage, and salt, with alfalfa hay except that wheat straw was fed in place of the alfalfa hay for the first 62 days to one lot. This lot and one other also received untreated cottonseed meal, whereas the other lots received cottonseed meal treated with calcium chlorid and linseed meal, respectively. The lot receiving the wheat straw made average daily gains of only 0.25 lb. and brought the lowest price per 100 lbs. at the end of the test. The lots receiving treated cottonseed meal and linseed meal both made average daily gains of 0.39 lb., and the fourth lot receiving untreated cottonseed meal made average daily gains of 0.4 lb. The finish and dressing percentage of the lots receiving linseed meal were the best, followed very closely by the lot receiving untreated cottonseed meal.

In comparing the cost of fattening lambs and wethers on the same feeds, it was shown that the lambs made 100 lbs. of gain at from \$3.31 to \$3.69 less than the wethers, due largely to the fact that the wethers required about 66 per cent more corn and 80 per cent more silage to produce 100 lbs. of gain.

Sheep feeding.—XI, Fattening western lambs, 1921-22, J. H. SKINNER and F. G. KING (*Indiana Sta. Bul. 263 (1922), pp. 15*).—In continuation of work previously noted (*E. S. R.*, 46, p. 477), 8 lots of 25 lambs each were selected to compare limited v. full feeding of corn, oat straw v. clover hay, cottonseed meal v. linseed meal, and restricted v. limited feeding of cottonseed and linseed meal with oat straw as roughage for fattening lambs during a 90-day feeding period. The rations fed consisted of cottonseed meal (0.25 lb. per head daily), corn silage, and clover hay, with shelled corn (7 parts to 1 of cottonseed meal) during the last 40 days of the feeding period; shelled corn ($\frac{1}{2}$ feed) during the entire period, with other feeds as above; and shelled corn and linseed meal or cottonseed meal (7:1 or 4:1), corn silage, and oat straw or clover hay.

The experiments on limited v. full feeding of corn were in agreement with previous results in that more rapid gains, better finish, and greater profits were made by liberal feeding of the corn. Liberal feeding of the corn for the last 40 days was better than its limited feeding for the entire feeding period. The average daily gains made by the respective rations were 0.318, 0.254, and 0.209 lb. In comparing oat straw with clover hay as roughages, one lot receiving clover hay with shelled corn, corn silage, and cottonseed meal, and another lot receiving linseed meal in place of the cottonseed meal made respective average daily gains of 0.318 and 0.291 lb. as compared with the respective gains of 0.249 and 0.24 lb. made by lots getting similar rations with oat straw substituted for the clover hay.

When the grain mixture was composed of 4 parts shelled corn and 1 part cottonseed meal or linseed meal, the respective average daily gains were 0.26 and 0.273 lb. It is concluded that when fed in limited quantities cottonseed meal is probably a little better than linseed meal, but that when fed in liberal quantities linseed meal is superior.

The results of practically all the tests were found to be in accord with the results of previous experiments. The calculated profits from the different lots ranked approximately in the same order as the average gains made by each lot.

Lamb feeding trials, C. H. Ruzicka (*North Dakota Sta. Bul. 158 (1922), pp. 87-93, fig. 1*).—A third lamb feeding trial, in continuation of the 1914 and 1915 trials (E. S. R., 35, p. 67), was carried on during 1916 in which 300 lambs averaging 50.2 lbs. per head were placed on stubble for 6 days in September. The lambs were then put on 6 acres of corn for 36 days, during which time they gained 1,821 lbs. From October 24 to January 11, while in the feed lot, they received a ration of corn-and-cob meal, refuse grain, whole barley, silage, and alfalfa hay. During this time an average of 2.14 lbs. of hay, 2.4 lbs. of silage, and 1.13 lbs. of grain were consumed per day. Beginning about 22 days after the silage was first fed, 19 lambs died and the silage feeding was discontinued. Later the silage was again fed with no fatalities. It was not determined whether the silage was responsible for the deaths of the lambs or not. During the test the lambs made an average daily gain of 0.22 lb. with a profit of \$2.91 per head, due largely to the high market at the time of sale.

A summary of the 1914 and 1915 trials is also given.

Lamb feeding experiments at the Irrigation Branch Station, H. HACKFORD, R. P. BEAN, and J. SOTOLA (*Washington Col. Sta. Bul. 170 (1922), pp. 4-24, fig. 1*).—The results of lamb feeding tests carried on during the winter of 1921-22 at the Washington Irrigation Substation at Prosser are reported in which 14 lots of 50 lambs each were fed for 60 days to compare first, second, and third cuttings of alfalfa hay, first cuttings of sweet clover and alfalfa hay, light and heavy rations of corn, rations of silage, hay, and grain with rations of hay and grain, and beet molasses as a substitute for part of the corn in rations for fattening lambs.

The daily rations per lamb were as follows: Lots 1, 2, 3, 4, and 7 0.75 lb. of corn, lot 5 1.5 lbs. of corn, lot 6 1 lb. of corn, lot 8 0.5 lb. of corn, lot 9 1.5 lbs. of corn and 1.5 lbs. of corn silage, lot 10, 0.75 lb. of corn and 1.5 lbs. of corn silage, lot 11 1.5 lbs. of grain mixture (7 parts corn and 1 part cottonseed meal) and 1.5 lbs. of corn silage, lot 12 0.75 lb. of the same grain mixture and 1.5 lbs. of corn silage, lot 13 0.25 lb. of corn, and lot 14 1 lb. of corn and 0.5 lb. of beet molasses. All lots had first cuttings of alfalfa hay before them at all times, except lots 2, 3, and 4 which received, respectively, second and third cuttings of alfalfa hay and the first cutting of sweet clover hay. The table following gives a summary of the results obtained.

Summary of lamb feeding experiments.

Lot.	Average per lamb.		Feed consumed per 100 lbs. gain.				Total digestible nutrients consumed per day.	Appraised value per 100 lbs.
	Initial weight.	Daily gain.	Shelled corn.	Hay.	Silage.	Beet molasses.		
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	
1 and 7.....	65.62	0.246	303	845	.....	.....	1.69	\$12.00
2.....	62.59	.214	348	961	.....	.....	1.69	11.80
3.....	65.44	.235	317	919	.....	.....	1.73	12.00
4.....	62.91	.294	253	755	.....	.....	1.73	12.00
5.....	63.04	.352	385	521	.....	.....	2.09	12.50
6.....	63.23	2.299	321	642	.....	.....	1.80	12.50
8.....	63.35	.218	229	1,014	.....	.....	1.55	11.35
9.....	62.91	.404	335	174	335	.....	1.86	12.00
10.....	62.50	.332	224	392	408	.....	1.64	11.90
11.....	63.73	.392	1 345	131	346	.....	1.74	12.50
12.....	63.84	.278	1 301	422	487	.....	1.57	11.70
13.....	63.61	.220	126	1,096	.....	.....	1.46	11.25
14.....	61.95	.357	269	455	.....	135	1.96	12.25

¹ Includes 43 lbs. cottonseed meal.² Includes 33 lbs. cottonseed meal.

The finish obtained on the lambs in the different lots is best determined by the appraised value per 100 lbs. A comparison of the different cuttings of alfalfa and sweet clover can be made by reference to the results obtained in lots 1, 2, 3, and 4. The results of lots 5, 6, 1, 8, and 13 show the comparative value of heavy or light rations of corn. The advantage of including corn silage in the ration is noted by comparing lots 5, 9, and 11 and lots 1, 10, and 12.

The addition of cottonseed meal to these rations did not show any advantages. The replacement of one-third of the corn by beet molasses in the ration fed to lot 5 was found to produce practically the same gain in the lambs of lot 14 at less cost. The finish of the molasses-fed group, however, was not quite as good as the finish of the lot receiving corn alone.

Pasturing sheep on irrigation ditches, E. G. NOBLE (U. S. Dept. Agr., Dept. Circ. 221 (1922), p. 57, figs. 3).—Pasturing irrigation ditches with sheep has been found at the Yuma Experiment Farm to be an effective method of keeping down vegetation and produces additional revenue from wool and mutton. The drawbacks to this method were the cost of fencing and losses by sheep-killing dogs.

Pusht-i-Kuh × Hashtnagari sheep at the agricultural experiment station, Peshawar, W. R. BROWN (Agr. Jour. India, 17 (1922), No. 3, pp. 264-270, pls. 3).—The author reports the crossing of a broad-tailed ram from the Pusht-i-Kuh with Hashtnagari ewes at the Peshawar Agricultural Experiment Station, India. The crossbreds proved to better than either parent in most respects, being heavier, longer bodied, better in the loin and constitution, and carrying their tails higher than the imported Pusht-i-Kuh. The dressing percentage and the fleece were also better in the crossbreds.

Attempts at crossing 10 Peshawari ewes with the Pusht-i-Kuh ram were unsuccessful.

Wool grades and grading, C. A. NORCROSS (Nev. Agr. Col. Ext. Bul. 30 (1922), pp. 11).—The general principles of wool grading are given for the benefit of wool growers. The grading of wool in the United States is based on soundness of fiber, length of staple, and diameter of fiber. Foreign wools are further graded according to shrinkage. Information is also given about the microscopical appearance of wool fibers, as well as reasons why certain grades of wool are used for different purposes and directions for properly handling and tying fleeces.

The metabolic and energy exchange of young pigs as determined by feeding experiments and analyses of the whole pig, O. WELLMANN (*Biochem. Ztschr.*, 117 (1921), No. 3-6, pp. 119-139; *abs. in Chem. Zentbl.*, 1921, III, No. 13, p. 886).—Following the digestion experiments on pigs previously noted (E. S. R., 44, p. 673), the author has made analyses of the whole bodies of eight pigs on the comparative rations, as well as analyses of four other control pigs of the same litters, and compared the energy and nitrogen exchanges in these pigs as determined by the analyses of the animals and by the intake and loss of nitrogen and energy in the feces and urine.

The energy required for growth was found to vary somewhat with the nitrogen content of the feed, it being larger in the pigs on the lower nitrogen diets. It is concluded, however, that on the average about 11.5 calories of available energy are required in the production of 1 gm. of organic matter by the young pigs. The assimilation of 1 gm. of protein and 1 gm. of fat was found to require, respectively, approximately 6 and 2.1 calories. The nitrogen exchange in the experimental pigs apparently checked well with the nitrogen content of these pigs and the controls.

Pasturing hogs on alfalfa, E. G. NOBLE (*U. S. Dept. Agr., Dept. Circ.* 221 (1922), pp. 35-27).—Experiments at the Yuma Experiment Farm previously noted on this subject (E. S. R., 43, p. 376), were continued during 1919 and 1920 with 8 and 10 pigs, respectively, in the spring lots and 7 and 14 pigs in the summer lots on $\frac{3}{4}$ -acre plats for each lot. During the spring periods of 121 and 132 days in the respective years, the pigs made average daily gains of 0.75 and 0.66 lb., consuming 2.3 and 3 lbs. of grain per pound of gain. During the summer periods of 69 and 56 days, respectively, average daily gains of 0.59 and 0.36 lb. were made, with the consumption of 3.9 and 1.73 lbs. of feed per pound of gain. It is concluded from 5 years' experiments that a 2 per cent grain ration of cracked grain sorghum or rolled barley, with alfalfa pasture, will produce a vigorous and thrifty stock hog, but a 3 or 4 per cent grain ration is required for most rapid fattening.

Pig feeding experiment (*Hampshire County Council, Agr. Ed. Com., Farm Inst., Sparsholt, Rpt. Expts.*, 1921, pp. 20-24).—Pens of six 10 to 12-weeks-old pigs each were fed for 21 weeks, beginning May 26, 1921, on barley meal in pen 1, palm nut cake in pen 2, coconut meal in pen 3, and semidecorticated peanut cake in pen 4. Pen 3 was fed on coconut meal for 15 weeks only. The above feeds were soaked in whey and other dairy products and supplemented daily with green stuff composed of alfalfa, oats and tares, and cabbage. The average daily gains produced by the respective pens were 1.49, 0.95, 1.07, and 1.07 lbs., and the amounts of grain consumed per pound of gain were 3.75, 4.15, 3.62, and 4.04 lbs., respectively. The dressing percentages were as follows: Pen 1, 75.44 per cent; pen 2, 71.7; pen 3, 70.61; and pen 4, 69.11 per cent. The best bacon was said to be produced by the pigs in pen 3, closely followed by pen 1, the fat of the pigs on palm nut cake and peanut cake being slightly soft. The greatest profits were shown by pens 2 and 4.

Preliminary studies of "posterior paralysis" in swine, L. A. MAYNARD (*Soc. Expt. Biol. and Med. Proc.*, 19 (1922), No. 8, pp. 427, 428).—The author briefly reports the occurrence of dry scaly skin covered with livid spots and stiffness of the hind legs, followed by much pain in the joints, posterior paralysis, and a rapid loss of weight in two pigs which had been fed for 90 days in dry lot on a ration consisting of 1 part hominy feed and 1.4 parts of pasteurized skim milk, together with a mineral mixture of charcoal, ground limestone, and salt. Feeding each pig 4 oz. of carrots per day and changing the mineral mixture to precipitated bone meal, precipitated calcium carbonate,

and salt were found to start recovery in 10 days and 3 weeks, respectively, in the two pigs. Recovery was nearly complete in 5 and 7 weeks.

The market value of horses with capped knees, E. NICOLAS (*Vie Agr. et Rurale*, 20 (1922), No. 22, pp. 377-380, figs. 2).—A discussion is given of the reasons for the decrease in value of horses with capped knees, and formulas are suggested for calculating the values of such horses of different types. These formulas depend upon the meat value of the animal, the purpose for which the animals are used, and their ability to walk, trot, or gallop.

The German shepherd dog, [M.] VON STEPHANITZ (*Der Deutsche Schäferhund in Wort und Bild*. Jena: Ver. Deut. Shäferhunde, 1921, 6. ed., rev. and enl., pp. VIII+771, pls. 4, figs. 496).—This book deals with the breeding, care, training, and showing of shepherd dogs. Much attention is given to the use of these dogs during the war and as police dogs. An introductory chapter of nearly 200 pages is given on the origin of shepherd dogs.

The rearing of chickens on the intensive system.—I, II, R. H. A. PLIMMER, J. L. ROSEDALE, A. CRICHTON, and R. B. TOPPING (*Biochem. Jour.*, 16 (1922), No. 1, pp. 11-22).—Two studies are here reported.

I. *The vitamin requirements* (pp. 11-18).—The authors report an experiment carried on at the North of Scotland College of Agriculture in which 24 Black and White Leghorn chicks were raised in confinement from July 13 to February 28 on a diet of oat meal and milk, with vitamins supplied by cod liver oil, marmite, and lemon juice. Only 3 of these birds were lost before maturity, 1 dying because of an accident.

During the test evidence is presented to show that the chicks were very susceptible to an insufficient amount of vitamin B, which may be associated with leg weakness. The amount of vitamin B required seemed to run parallel to the amount of carbohydrates and fat supplied in the diet.

From January 14 to February 28 the pullets which were laying were divided into two lots, one being given 12 gm. of marmite per day and the other lot 6 gm. of raw marmite and 6 gm. of marmite which had been heated to destroy the vitamin. The first lot started laying a little earlier, but there was practically no difference in total egg production.

II. *The effect of "good" protein* (pp. 19-22).—In continuing the above study, 9 White Leghorn chicks were fed a basal diet of oat meal supplemented by a mixture of secwa (dried whey) and caseinogen, as well as cod liver oil, marmite, and lemon juice in amounts to supply sufficient vitamins, from August 21 to January 13. The cockerels reached average weights of 1,828 gm. in 122 days and 2,002 gm. in 144 days, and the pullets started laying at 139 days of age.

The nutritive ratio of the feed was 1:6 for the first 4 days when no caseinogen was fed, after which the addition of caseinogen to the ration made it 1:2.5. The gradual increase in the proportion of oat meal fed as the birds grew older resulted in a nutritive ratio of 1:4 during the last part of the trial. A comparison of the above ration for egg production of the pullets and a ration in which blood meal replaced the lactalbumin, caseinogen, marmite, and some of the lemon juice indicated that the former ration was superior, probably due to the presence of more vitamin B.

Selection and care of the breeding flock, MRS. G. R. SHOUP (*Western Washington Sta. Bmo. Bul.*, 10 (1922), No. 4, pp. 67-70).—This is a discussion of the principles to be observed in selecting and caring for breeders.

Selection of breeders without the trap nest, W. H. ALLEN (*New Jersey Sta., Hints to Poultrymen*, 11 (1922), No. 1, pp. 4).—Methods are described for selecting breeding stock when trap nest records are not available.

Trapnesting, G. R. SHOUP (*Western Washington Sta. Bimo. Bul.*, 10 (1922), No. 4, pp. 70-75, figs. 3).—Trapnesting is a necessary operation for poultry breeders who wish to pedigree their chicks, but for ordinary culling purposes is not necessary. A description is given of the construction of a satisfactory trap nest, with recommended methods for banding the birds and keeping records.

How to caponize, G. ROBERTSON and W. W. LEE (*Canada Dept. Agr. Pamphlet 12, n. ser.* (1922), pp. 6, figs. 6).—General directions are given for caponizing, with illustrations of the operation and the instruments to be used.

Methods for the exhibitor, G. W. HERVEY (*New Jersey Stat., Hints to Poultrymen*, 11 (1922), No. 2, pp. 4, fig. 1).—This describes the management and selection of birds for exhibition.

Increased blood sugar coincident with ovulation in pigeons, H. E. HONEYWELL and O. RIDDLE (*Soc. Expt. Biol. and Med. Proc.*, 19 (1922), No. 8, pp. 377-380).—Data giving the amount of sugar found in the blood of 14 pigeons during ovulation and more than 36 hours away from ovulation showed that in all but two cases there was more sugar present during ovulation. These results indicate that the similarity of the rise in blood sugar with the hypertrophy of the suprarenals during ovulation (E. S. R., 48, p. 167) is further evidence of the relationship of the suprarenals to carbohydrate metabolism and to the sexual functions.

DAIRY FARMING—DAIRYING.

Successful dairying, J. KLEIN (*Erfolgreiche Milchviehwirtschaft. Berlin: Paul Parey, 1922, 3. ed., rev., pp. VIII+349, figs. 94*).—This is a general textbook, dealing with the methods of handling and manufacturing milk and containing chapters on the character and origin of milk, testing milk, handling milk, selling milk, manufacture of butter and cheese, making milk drinks, and management of the dairy.

A handbook of dairy statistics, T. R. PERTLE (*U. S. Dept. Agr., Bur. Anim. Indus.*, 1922, pp. 72, fig. 1).—Statistics of interest to the dairy industry have been condensed and reported, dealing with the numbers of cattle, and the production, consumption, manufacture, exports, and imports of dairy products by the United States and foreign countries.

Feeding the dairy cow, C. R. GEARHART (*Kans. Agr. Col. Ext. X Form No. 188* (1922), pp. 3).—General principles of feeding dairy cows are given, as well as some suggested grain rations.

Feeding dairy animals, J. M. FULLER (*N. H. Agr. Col. Ext. Circ. 52* (1922), pp. 16, fig. 1).—The principles of feeding dairy cattle are given, with special reference to the cost of rations for dairy cows, bulls, and young stock.

Feeding dairy cows, C. A. HUTTON (*Tenn. Agr. Col. Ext. Pub. 100* (1922), pp. 38, figs. 7).—This bulletin gives practical directions for feeding dairy cattle, dealing with the practical use of the more common dairy cattle feeds. A number of grain mixtures are suggested, and the methods of mixing feed at home are described.

About winter-feeding dairy cows, H. E. McNATT (*Western Washington Sta. Bimo. Bul.*, 10 (1922), No. 4, pp. 75-77).—The feeding of a well-balanced ration containing silage or roots, or both, is recommended for dairy cattle during the winter.

The dairy heifer and her calf, B. W. FAIRBANKS (*Colo. Agr. Col. Ext. [Bul.] 193A* (1922), pp. 16, figs. 10).—The recommended methods for selecting, feeding, managing, and caring for dairy heifers are given for the special benefit of boys and girls enrolled in calf clubs.

The digestibility of the differently manufactured debittered lupines and their value for milk production, A. MORGEN, C. WINDHEUSER, G. SCHÖLER, and E. OHLMER (*Landw. Vers. Sta.*, 99 (1922), No. 6, pp. 295-357).—The results of digestion experiments are reported in which finely and coarsely ground lupine seed and lupine meal having the seed coats removed, were fed to wethers, pigs, and rabbits in combination with other feeds including hay, straw, beet leaves, and potato flakes. The digestibility of the crude protein in the lupine meal and seed varied from 83.7 to 94.3 per cent. The digestibility of the organic matter varied from 85.2 to 93.9 per cent for the wethers and pigs, but went as low as 51.3 per cent for the rabbits.

A series of experiments were carried on with 3 ewes and 4 goats to compare lupine meal and ground lupines with ground soy bean cake for milk production. In making these comparisons, basal rations of meadow hay and straw were fed, with sufficient potato pulp added in each case to equalize the rations as to energy and digestible protein content. In general, the averages indicated that the debittered lupine and soy bean cake were of about equal value for milk production.

A weight-height-age curve as a measure of the state of nutrition and of growth of the dairy cow, S. BRODY and A. C. RAGSDALE (*Jour. Dairy Sci.*, 5 (1922), No. 5, pp. 479-848, figs. 3).—Reference is made to the differences which exist between the weights of individual helpers and the average weight of the heifers of each breed in the University of Missouri dairy herd, and data and curves are presented to show that when the height of the helpers is considered with reference to the weight, the growth curves even of Holsteins and Jerseys are almost identical. Considering the weight in relation to the height as a method of measuring growth of dairy cattle for experimental work is suggested.

Manual for cow testing associations and milk inspectors, H. B. HYLKEMA (*Handleiding voor Melkcontrôle en Melkonderzoek in For- en Contrôlevereenigingen. Doetinchem, Netherlands: C. Misset, 1922, pp. [61]+100, pls. 5, figs. 6*).—This book is based on the experience of cow-testing associations in Utrecht, and gives information for the use of members of cow-testing associations and directions for testing milk and keeping records.

Herd testing rules and conditions (*So. Aust. Dept. Agr. Bul. 137, rev. (1922), pp. 8*).—This gives the regulations governing the award of government subsidies and prizes to herd-testing societies.

The testing of purebred cows in New South Wales, L. T. MACINNES (*N. S. Wales Dept. Agr., Farmers' Bul. 147 (1922), pp. 46, figs. 6*).—This is the usual annual report of the testing of dairy cattle in New South Wales for the year ended February 28, 1922 (*E. S. R.*, 46, p. 771).

Milk recording (*London: Min. Agr. and Fisheries, 1921, rev. ed., pp. 34*).—After a general discussion of the value of the milk records of dairy cows, the milk recording scheme of the Ministry of Agriculture of Great Britain is described somewhat in detail, and a description is given of the annual register of dairy cows and suggested methods for registration and marking by milk recording societies of calves and bulls.

The milk survey of twenty Kansas cities (*Bul. Kans. Bd. Health, 18 (1922), No. 11, pp. 273-319*).—A survey of the milk in 20 Kansas cities by the State board of health has emphasized the necessity of care in producing milk and the lower bacterial counts which usually result when the milk is properly cooled and cared for.

A tropical milk supply, A. BRUCE (*Analyst, 47 (1922), No. 556, pp. 288-294*).—The analyses of 500 samples of cow's milk and buffalo's milk, as collected in Ceylon, were compared. The averages for the cow's and buffalo's milk,

respectively, were specific gravity 1,029.5 and 1,030.0, total solids 13.65 and 17.87 per cent, fat 5.03 and 8.47, sugar and casein 7.92 and 8.59, and ash 0.7 and 0.81 per cent.

Testing dairy products, M. R. TOLSTREP (*Clemson Agr. Col. S. C., Ext. Circ.* 38 (1922), pp. 14).—Directions for testing milk, cream, and other dairy products for fat by the Babcock test are given, as well as methods of testing butter for moisture and salt, and milk for acidity.

The technical control of dairy products, T. MOJONNIER and H. C. TROY (*Chicago: Mojonnier Bros. Co., 1922, pp. XXX+909, pl. 1, figs. 193*).—This work consists largely of a detailed discussion of the chemical and physical analyses of normal milk and milk products, with instructions as to the best methods of making analyses, much emphasis being placed on the Mojonnier tests for determining the fat and moisture content. Directions are also given for standardizing the various dairy products, as well as methods of manufacturing evaporated milk, dried milk, and score cards for dairy products. The methods employed in a bacteriological examination of milk are given, as well as a chapter on the definitions and standards in the different States for dairy and related products.

The bacteriological control of milk production, J. W. BIGGER (*Jour. Hyg. [London], 21 (1922), No. 2, pp. 149-154, figs. 2*).—The cause of the large bacterial count which occurred in milk delivered to two Dublin hospitals was studied, and found to be largely due to the lack of care and the use of insufficient soap and hot water or steam in washing the milk cans.

Further studies on the biology of lactic acid bacteria, D. C. GORINI (*Milchz. Zentbl., 51 (1922), No. 16, pp. 181-184*).—The studies of the properties of lactic acid bacteria previously noted (*E. S. R., 47, p. 79*) are reviewed, and the results of more recent studies carried on by the author are reported.

Actinomyces in milk with special reference to the production of undesirable odors and flavors, C. R. FELLERS (*Jour. Dairy Sci., 5 (1922), No. 5, pp. 485-498, pls. 2*).—In studying the cause of an offensive taste and odor in milk from a New Jersey dairy, the author found that 11 species of actinomyces were present in this milk, the most active species being *Actinomyces griseus* and *A. albus*. By inoculating normal milk the offensive odor and taste was produced in from 24 to 48 hours. Cultures of actinomyces were also isolated from hay, straw, grain, soil, dusty air, manure, and musty walnuts, dried fish, and corn meal. Czapek's agar was very satisfactory as a medium on which to grow the actinomyces cultures.

The influence of certain factors on the methylene blue reduction test for determining the number of bacteria in milk, E. G. HASTINGS, A. DAVENPORT, and W. H. WRIGHT (*Jour. Dairy Sci., 5 (1922), No. 5, pp. 438-454; abs. in Ice Cream Trade Jour., 18 (1922), No. 10, pp. 77, 78*).—Experiments are reported which have been carried on at the University of Wisconsin to study the effect of the concentration, age, and different brands of methylene blue; the temperature of the milk; the types and condition of bacteria present; the reaction of the milk; shaking; and the keeping qualities of the milk on the time required for reduction to take place in the methylene blue reduction test previously described (*E. S. R., 44, p. 675*). The dependence of the action of the test on the activity of the cells is brought out, and the explanation of the differences indicated by this test and plate counts is given as due to the fact that a clump of bacteria show as one colony in the latter case, whereas their vital activity as indicated by results of the methylene blue test is as individual cells.

Directions for making the reduction test are given, in which it is explained that the methylene blue should be diluted slightly more than 200,000 times in the milk, and that during reduction the milk should be held at 38° C.

The bacteriological condition and keeping qualities of grade "A" (certified) milk during the year 1921, A. T. R. MATTICK and R. S. WILLIAMS (*Jour. Hyg. [London]*, 21 (1922), No. 2, pp. 134-138).—Determinations during 1921 of the bacterial counts and keeping qualities of samples of grade "A" milk from four farms which have been previously studied (*E. S. R.*, 48, p. 79) have shown, as in earlier work, that the delivery of milk to the consumer within 24 hours after production at a temperature of not over 60° F. will usually keep the bacterial count below 30,000 per cubic centimeter. Such milk will usually keep for a reasonable time in the hands of the consumer, especially if it is put in a cool place.

The care of morning milk before pasteurization, H. MACY (*Jour. Dairy Sci.*, 5 (1922), No. 5, pp. 502-506).—The author reports a study of the temperature and bacterial counts of 24 samples of uncooled morning milk, as observed at hourly intervals for a period of 5 hours after milking, during the summer months, to determine if it is necessary to have morning milk cooled before delivering to the milk plant for pasteurization.

Where the original bacterial counts were low, the bacterial counts of the milk after 5 hours were satisfactory for pasteurization without cooling, but where the original counts were high, the counts after 5 hours were usually over 1,000,000. The bactericidal property of the milk was shown by counts during the first, second, and third hours, being in some cases lower than just after milking, so that the time elapsing between milking and pasteurization is an important consideration, but, as a general rule, it can not be said that it is safe to let morning milk go uncooled.

Separation of cream, E. S. GUTHRIE (*N. Y. Agr. Col. (Cornell) Ext. Bul.* 51 (1922), pp. 193-211, figs. 15).—This discusses the different methods of separating cream with reference to the losses which occur by each method. Suggestions are also given for selecting, operating, and cleaning separators.

Making butter on the farm, G. L. MARTIN (*Mont. Agr. Col. Ext. [Pub.] No. 57* (1922), pp. 14).—General instructions are given for making butter on the farm.

The causes of leaky butter, A. C. DAHLBERG (*Jour. Dairy Sci.*, 5 (1922), No. 5, pp. 421-437, fig. 1).—The author reports the results of experiments carried on at the University of Wisconsin to determine the causes of leaky butter. The determinations of leakage were made by a leakage tube which consisted of a tin cylinder holding 28 lbs. of butter, sealed at one end, and tapering at the other so that the water leaking out could be measured. A warm churning temperature, not holding the cream cold after pasteurization a sufficient time before churning, or the presence of a large amount of soft fat produced butter which appeared wet, but these conditions had no effect on the leakage which occurred. Other factors which were found not to influence leakage were the moisture content and the time of year in which the butter was made.

The amount of working the butter was found to have more influence on leakage than any other factor. Too little working was said to have larger spaces between the fat globules and was a distinct cause of leaky butter. Other factors tending to cause it were working the butter in water, high salt content, large churnings, cold wash water, and storage temperature too low. The openness of the texture of butter is the best indication of leakiness, whereas the wet appearance is not necessarily an indication.

Farm cheese making, G. L. MARTIN (*Mont. Agr. Col. Ext. [Pub.] No. 56* (1922), pp. 12, figs. 6).—General instructions are given for making cheese on the farm.

VETERINARY MEDICINE.

Twenty-fifth annual meeting of the United States Live Stock Sanitary Association (*U. S. Live Stock Sanit. Assoc. [Rpt.]*, 25 (1921), pp. 190).—The papers and reports of committees here presented relate largely to infectious abortion, bovine tuberculosis, and swine diseases. The papers presented include Suggestions for the Improvement of the Reproductive Efficiency of Cattle, by W. L. Williams (pp. 57-64); Bureau of Animal Industry Investigations on Bovine Infectious Abortion, by E. C. Schroeder (pp. 65-77); Herd Control of Infectious Abortion in Cattle, by T. H. Ferguson (pp. 77-79); Result of a Project to Determine the Comparative Value of the Subcutaneous-Intradermal Tuberculin Tests, by S. E. Bruner (pp. 107-113); Methods by which Tuberculosis is Spread, by J. S. Healy (pp. 113-117); The Simultaneous Vaccination Against Anthrax with Special Reference to Anaphylaxis, by A. Eichhorn (pp. 117-120); Factors Influencing the Control of Swine Diseases, by E. A. Cahill (pp. 141-146); and Report of Experiments with Sulpestifer Bacterins, by M. Dorset (pp. 146-152).

Communicable diseases of animals (*War Dept. [U. S.] Army Regulat. Nos.* 40-2090 (1921), pp. 4; 40-2095 (1922), pp. 4; 40-2100 (1921), pp. 7; 40-2105 (1921), pp. 3; 40-2110 (1921), pp. 3; 40-2115 (1921), pp. 3; 40-2125 (1921), pp. 4; 40-2130 (1922), pp. 3; 40-2135 (1922), pp. 2).—These summaries of information prepared for use by the Veterinary Corps of the Army include accounts of communicable diseases of animals in general, disinfection, glanders, the ophthalmic mallein test, the intradermic mallein test, shipping fever, mange, surra, and dermatitis gangrenosa, three of which have been previously noted (*E. S. R.*, 48, pp. 81, 82).

The principal stock-poisoning plants of New Mexico, E. P. JOHNSON and W. A. ARCHER (*N. Mex. Agr. Col. Ext. Circ.* 71 (1922), pp. 40, figs. 22).—This is a summary of information on the more important stock-poisoning plants that occur in New Mexico.

The influence of age and temperature on bacterial vaccines, II, W. F. HARVEY and K. R. K. IYENGAR (*Indian Jour. Med. Research*, 10 (1922), No. 1, pp. 192-202).—Continuing the investigation previously noted (*E. S. R.*, 48, p. 177), further evidence on the keeping qualities of vaccines is presented in protection experiments with pigeons inoculated with the fowl cholera organism *Bacillus avisepticus*. Agglutination and turbidity tests were also made as in the previous study. The vaccine, a standardized suspension in salt solution, was stored at room temperature of from 10 to 20° C. (50 to 68° F.) and at 37°, and was used at intervals of 30 days from the time of preparation up to 450 days. Several pigeons were used for each test with a similar number of controls.

As regards protection, the vaccine when freshly prepared was less efficient than after standing for the various periods up to 9 months, but more efficient than that which had been stored from 12 to 15 months. No effect of temperature could be noted.

The agglutination reaction varied from month to month, but did not appear to decrease with increasing length of time as did the protective power. There was no appreciable difference between the effect produced by vaccines kept at different temperatures. It is concluded that agglutination, while indicating to some extent that protection has been secured, can not be used as an index to the degree of protection.

There was no significant change in the turbidity of the vaccine throughout the entire period, thus showing that the turbidity of an antigen can not be taken as a measure of its protective power.

The advantage of single and fractional dosage in prophylactic inoculation. W. F. HARVEY and K. R. K. IYENGAR (*Indian Med. Jour. Research*, 10 (1922), No. 2, pp. 424-429).—To determine whether a single large dose of protective vaccine can safely replace the same dose given fractionally at different intervals of time, a series of pigeons was inoculated with the prophylactic antigen for *Bacillus avisepticus* (1) in a single dose of 1.5 cc., (2) in a dose of 0.5 cc. and a second dose of 1 cc. after 7 days, and (3) in three portions of 0.5 cc. each at 7-day intervals. The infecting dose was administered in each case 12 days after the last inoculation, and in the case of the single dose one series also received the infecting dose 19 days after the prophylactic. For the range of dosage of 0.000,000,005 mg. to 0.000,000,5 mg., out of 58 untreated pigeons all died; of 15 treated with a single dose of antigen and tested 12 days later, 12 died; of 15 treated with a single dose of antigen and tested 19 days later, 11 died; of 15 treated with two doses of antigen and tested 12 days later, 7 died; and of 15 treated with three doses of the antigen and tested 12 days later, only 1 died.

It is concluded that there is a distinct advantage in dividing the dose of prophylactic antigen. It was also found that the production of agglutinins was greater with divided inoculation than with a single inoculation of the same total amount.

The source of the microorganisms in the lungs of normal animals. F. S. JONES (*Jour. Expt. Med.*, 36 (1922), No. 3, pp. 317-328).—"It has been possible to show that the lungs of such animals as the calf, rabbit, guinea pig, white rat, and white mouse are readily invaded by organisms. The most frequent types observed in cultures from the border of the lungs have been streptothrix, molds, and bacteria of the *Bacillus subtilis* group. These forms originate in certain dry foodstuffs (hay and straw). By withholding or moistening these materials it has been possible to diminish the number of organisms in the lungs. When these materials have been supplied to mice whose lungs under usual conditions contain only a few organisms, the number of positive cultures increases and is comparable with those of the larger animals. The bronchial lymph glands of all guinea pigs examined developed, in 66½ per cent of the tubes, organisms similar to those obtained from the lungs."

Studies on pneumococcus immunity.—I, Active immunization of monkeys against pneumococcus Type I pneumonia with pneumococcus Type I vaccine. R. L. CECIL and G. I. STEFFEN (*Jour. Expt. Med.*, 34 (1921), No. 3, pp. 245-258, figs. 5).—Experiments are reported which demonstrate that monkeys can be completely protected against experimental pneumococcus Type I pneumonia by the subcutaneous injection of three large doses of pneumococcus Type I vaccine, or by the intravenous injection of small doses of the vaccine. The vaccine employed was a saline suspension of killed pneumococci. There appeared to be no relation between the active immunity thus secured and the presence or absence of protective substances in the serum of the vaccinated animals.

Vaccination of monkeys against pneumococcus Type I pneumonia by means of intratracheal injection of pneumococcus Type I vaccine. R. L. CECIL and G. I. STEFFEN (*Pub. Health Rpts. [U. S.]*, 37 (1922), No. 44, pp. 2735-2744, figs. 3).—The intratracheal inoculation of monkeys with pneumococcus Type I vaccine was found to be even more effective than the subcutaneous inoculation noted above in that immunity was secured not only by large doses but also by very small doses of the vaccine. Attempts to produce immunity against pneumonia in monkeys by spraying the throat with pneumococcus vaccine were not successful, but it is thought that the failure under

these circumstances may have been due to the fact that the animals, by closing off the nasal pharynx, prevented the vaporized vaccine from entering the trachea. As in the previous work, little or no protective substance against pneumococcus could be demonstrated in the serum of the monkeys vaccinated by this method, thus indicating that the immunity is probably cellular in character.

Ten new cases of anthrax.—Efficacy of antianthrax serum, P. PERRIN (*Jour. Physiol. et Path. Gén.*, 20 (1922), No. 3, pp. 404-409 figs. 4).—A brief report is given of 10 cases of human anthrax which were treated successfully with antianthrax serum in connection with cauterization and antiseptic dressings.

Hemorrhagic septicemia in Cortland County, E. V. MOORE and J. L. McAULIFFE (*Cornell Vet.*, 12 (1922), No. 4, pp. 289-294).—In this discussion of hemorrhagic septicemia as it has occurred among cattle in Cortland County, N. Y., the symptoms and post-mortem findings are reported for one case of each of the three forms in which the disease has manifested itself, namely, pulmonary, edematous (exanthematous), and nervous. From each of these cases on autopsy *Bacterium bovissepticum* was isolated.

It is stated that, beginning with the first outbreak in 1919, there have been treated 85 cases in 51 dairies, in which there was a total of 1,399 animals. Of the 85 cases 38 died, and autopsies on 33 of these fatal cases showed lesions typical of one or more of the three forms of the disease, although in 30 per cent of the cases the findings were negative for *B. bovissepticum*. The treatment consisted essentially in the administration of hemorrhagic septicemia serum, which was injected intravenously in doses of 100 cc. The treatment was repeated daily for three days, or longer if necessary. Practically all of the animals, sick or well, also received injections of hemorrhagic septicemia bacterins. In four herds in which the animals were injected with the bacterin before any cases appeared, 18 cases developed with 3 deaths. The survivors in three of the herds received another injection of the bacterin. At the time of writing no further cases had developed.

Transmission of piroplasmosis in France by *Dermacentor venustus*, E. BRUMPT and F. LARROUSSE (*Bul. Soc. Path. Exot.*, 15 (1922), No. 7, pp. 540-545, fig. 1).—In experiments with the spotted fever tick (*D. venustus*) received from Montana, the authors have found that the female progeny from an adult that has engorged on an infected dog will transmit piroplasmosis to a healthy dog, even though its life as a larva and nymph was passed on refractory hosts (guinea pig, hedgehog). It is pointed out that three ticks have been known to transmit the disease, namely, *Haemaphysalis leachi*, *Rhipicephalus sanguineus*, and *D. reticulatus*.

Prophylactic treatment for rabies by means of standardized glycerinated virus, J. McI. PHILLIPS (*Jour. Immunol.*, 7 (1922), No. 5, pp. 409-421, fig. 1).—A method of preserving rabies virus in glycerin is described, the technique for the preventive treatment with virus is outlined, and the results obtained in a large number of cases on this treatment are reported.

For the preparation of the virus young rabbits from a known source are inoculated intracerebrally with from 0.015 to 0.075 mg. of fixed virus suspended in salt solution. When the animals are completely paralyzed and appear to be moribund they are killed by bleeding. The brain is removed, weighed, rubbed to a smooth paste in a mortar, and triturated slowly with glycerin until the total volume of fixed virus and glycerin is such that each 0.1 cc. of the suspension contains 15 mg. of the fresh virus. Small amber glass ampoules are then filled well up into their necks with the glycerinated virus and placed in separate test tubes which contain a little cotton to protect the neck of the

ampoule from breaking. Above the ampoule is placed a wad of absorbent cotton. The tubes are placed in the ice box for a few hours and are then filled to the top with pyrogallie acid, after which 2 or 3 cc. of 40 per cent potassium hydroxide is added and the tubes closed with a little absorbent cotton and tightly-fitting rubber stoppers. The tubes are stored in test tube baskets at a temperature of from -2 to -4° C. until required, the ampoules then being removed by breaking the test tube. It is stated that ampoules filled in this way and kept in cold storage for eight months show no change in virulence, even when oxygen has not been absorbed from the test tube.

In discussing the dosage and duration of the treatment, attention is called to the occasional failures which have occurred in animals which have been given a 6-day intensive treatment, and it is emphasized that changes in the length and intensity of treatment must be undertaken cautiously.

The antigenic property in vivo of methyl extracts of tubercle bacilli, A. BOQUET and L. NÈGRE (*Compt. Rend. Soc. Biol. [Paris]*, 86 (1922), No. 11, pp. 581, 582).—A brief report is given of a study in vivo of the antigenic properties of the methyl extract of tubercle bacilli prepared as previously described (E. S. R., 46, p. 376).

This extract was added drop by drop with constant shaking to an equal quantity of distilled water. The milky solution thus obtained was kept on the water bath at from 85 to 90° C. until the methyl alcohol had evaporated. Rabbits which had received, 4 weeks previously, an intravenous injection of 0.01 mg. of very virulent bovine tubercle bacilli, received every other day for 5 days injections in the ear vein of 3 cc. of the aqueous emulsion corresponding to 0.03 gm. of the dried bacilli. The animals were bled after the last injection and the serum titrated in the presence of the methyl antigen. The serum showed an increase in antibodies from 20 to 1,200 units. The two rabbits receiving the injection survived the control by 30 and 60 days, respectively.

A healthy rabbit whose serum did not fix complement with extracts of tubercle bacilli received similar injections of the aqueous extract, following which 1 cc. of its serum fixed 70 minimum active doses of alexin. It is concluded that the alcohol extract of tubercle bacilli, which contains only the fraction of bacillary lipoids insoluble in acetone and soluble in methyl alcohol, is similar in its antigenic properties to the protein substances.

The antigenic properties of methyl alcohol extracts of tubercle bacilli and of lecithin, A. BOQUET and L. NÈGRE (*Compt. Rend. Soc. Biol. [Paris]*, 86 (1922), No. 13, pp. 717-719).—As a result of the observation that the active antigen of the tubercle bacilli is insoluble in acetone and soluble in alcohol, that such an extract is capable of hemolyzing cobra venom as do solutions of lecithin, and that the serum of tuberculous subjects is rich in lecithin, a study has been made of the antigenic value of ovolecithin.

Rabbits were injected at 2-day intervals with 0.01 cc. of lecithin in aqueous emulsion and bled 9 days after the fifth and last injection. The serum thus obtained fixed alexin in the presence of lecithin, tuberculin, the methyl extracts of tubercle bacilli, and of diphtheria bacilli, but not in the presence of *Bacillus subtilis* or the Wassermann antigen. The similarity in behavior in lecithin emulsions and methyl extracts of tubercle bacilli is thought to indicate that the antigenic property in vivo of the alcoholic extracts of tubercle bacilli is due to the presence of phosphatids or complexes of phosphatids. In vitro the action of lecithin was, however, less specific than the methyl extracts of tubercle bacilli.

It is, therefore, concluded that in the methyl extracts of tubercle bacilli there exist, first, a substance of lipoid nature common to several microbial species and capable of provoking in vivo the formation of antibodies similar to those

developed by ovolecthin, and second, substances more strictly specific which, associated with the above-named lipoid, behave in vitro as a very sensitive antigen.

Experiments with the intrapalpebral tuberculin test (lid test) with cattle. E. JANUSCHKE (*Monatsh. Prakt. Tierheilk.*, 33 (1922), No. 7-9, pp. 237-245).—This is a brief discussion of the technique, interpretation, and value of the intrapalpebral tuberculin test in cattle.

Some notes on the cause and control of calf scour, G. E. JORGENSEN (*North Amer. Vet.*, 3 (1922), No. 11, pp. 593-597, 617).—In work which has been conducted by the author for the past six years on calf scours, the proportion of the cases in which different pathogenic organisms have been isolated is reported to be as follows: Members of the colon group 42 per cent, streptococcus 38, *Bacterium abortus* 8, *B. pyogenes* and *B. pyocyaneus* 3, hemorrhagic septicemia group 8, actinomyces 0.4, and an unidentified coccidium 0.6 per cent. The two organisms which are apparently the most important factors in calf scours have been made the subject of immunological studies which are reported briefly.

Two calves from a herd in which streptococcal infection was present were killed at the height of an attack of infectious enteritis and autopsied. Cultures of streptococci isolated from the two animals were smeared on the sides of two capillary tubes and the smears overlaid with the whole coagulable blood of young calves. It was found that culture A from the first calf would grow in dilutions of only 1:640, while culture B from the second calf would grow in dilutions up to 1:1,280. Chicken blood entirely inhibited the growth of the organisms, as did also the blood of a calf immunized against killed cultures of the two organisms. The blood of another calf immunized with a stock bacterin containing several of the colon organisms prevented entirely the growth of culture A and inhibited to a considerable extent the growth of culture B.

Culture B proved more pathogenic for calves than culture A, as one calf fed the former died while another fed the latter remained in good health. This calf was then fed culture B and developed an acute enteritis from which it finally recovered. During the course of the disease the growth titer of B in the blood of this animal rose to 1:2,000 and on recovery dropped to 1:160. By intravenous inoculation with killed, followed by living, cultures of B, the calf was rendered hyperimmune. Rabbits which had been demonstrated to be susceptible to culture B were protected against live cultures of the same organism by injection of serum from the hyperimmunized calf, as well as by three 3-day interval injections of a killed culture of B.

A few studies were also made of colon bacilli isolated from a fatal case of scours. Cultures of this organism fed to healthy 2-day old calves caused a fatal enteritis. The organism proved capable of growth in normal calf blood in dilutions as great as 1:1,280, while blood from calves which had been immunized with killed cultures inhibited the growth of the organism to a dilution of 1:160. Growth tests in hog blood showed an almost complete inhibition in dilutions as low as 1:160, but in dilutions of 1:80 the organism grew luxuriantly. In a later outbreak of calf scours due to the same organism a commercial calf scour serum was used on the three infected calves with marked improvement in from 2 to 3 days. The same serum, however, failed to alter the course in two other outbreaks which were later found to be due to a coccidium.

It is concluded that commercial bacterins give favorable results provided they contain organisms which are homologous to the causative agent. It is

recommended that commercial bacterins for this disease should contain both organisms of the colon group and streptococci.

An epidemiological study of rhinitis (Coryza) in calves with special reference to pneumonia, F. S. JONES and R. B. LITTLE (*Jour. Expt. Med.*, 36 (1922), No. 3, pp. 273-284).—This is a report of studies made during an outbreak of pneumonia which occurred in November and December, 1921, among calves in a large dairy herd that had been under observation since 1917. Cases of pneumonia among calves in this herd were noted by Smith in 1917 (*E. S. R.*, 45, p. 385), and 12 cases of calf pneumonia were studied by him in 1919. In 9 instances *Bacillus actinoides* was found, and *B. bovissepticus* was also associated with 3 or 4 of these. During the latter part of October and throughout November, 1920, there occurred a severe outbreak of pneumonia in adult cows which had been shipped from Michigan. During the outbreak that occurred in November, 1921, 32 cases in one barn were exposed to the disease, and 10 clinical cases developed, 2 dying of diffuse pneumonia.

"From these, *B. bovissepticus* group 1 [associated with the outbreak in 1920 and sporadic cases during 1920 and 1921] organisms were obtained at autopsy. Four affected with pneumonia and 8 other calves which failed to show symptoms of pneumonia developed a purulent rhinitis. From the nasal exudate of these cases group 1 organisms were cultivated. The characteristic rhinitis was reproduced experimentally by brushing the nasal mucosa with a swab dipped in culture. Certain of the calves which suffered from the spontaneous rhinitis continued to carry the organisms in the nasal passages for periods as long as 121 days. After the first outbreak had subsided, practically all calves introduced into this barn developed a milder type of rhinitis associated with organisms of group 2 *B. bovissepticus* [associated with *B. actinoides* pneumonia in 1917, 1919, and 1920]. Twenty-five per cent of such calves continued to carry the organism on the nasal mucosa for periods of 50 to 73 days. It was possible to induce nasal infection in calves with pure cultures of this organism."

An experimental study of infectious abortion in swine, F. B. HADLEY and B. A. BEACH (*Wisconsin Sta. Research Bul.* 55 (1922), pp. 35, figs. 4).—This is the report of preliminary investigations on infectious abortion in swine following its appearance in the university breeding herd in 1920. The disease was introduced through 3 bred sows purchased at different sales. Within 6 months after the introduction of the purchased animals about 25 per cent of the sows in the herd either aborted or failed to farrow. On applying the agglutination test to all the animals in the herd, 1 of the 5 boars and 51 of the 83 sows reacted to the test, and within a few weeks after the test 30 of these reactors aborted. From the sows which had aborted and from their aborted fetuses were obtained 2 strains of *Bacillus abortus* which appeared, morphologically and culturally, to be the same as bovine strains of this organism, but biologically to be slightly different as shown by the fact that the porcine strain proved more pathogenic for guinea pigs than the bovine strain.

To test further the relationship between swine and cattle abortion, 4 pregnant gilts were infected by intravenous injection of a salt suspension of 4 different strains of abortion bacilli of porcine origin and 4 others similarly with a suspension of 4 bovine strains. Of the former group all gave characteristic agglutination tests within a week, and all aborted with the possible exception of 1 which was thought to have aborted and eaten its fetuses. Two of the animals developed a reaction fever 2 days after inoculation. None of the animals infected with bovine organisms developed a thermal reaction, and all farrowed normally. All, however, reacted to the agglutination test for both strains. Of 3 control gilts which gave negative agglutination tests, 2

farrowed normally and 1 farrowed 6 full-grown dead fetuses from which, however, abortion bacilli could not be obtained.

Two heifers were inoculated with the bovine and porcine strains, respectively. Both gave the agglutination test, and both aborted 58 and 59 days after inoculation.

Attempts to infect gilts by feeding the abortion bacilli gave negative results as far as actual abortion was concerned in 3 out of 4 cases, although all reacted to the agglutination test for the specific organism. Conflicting results were obtained following intravenous inoculation, 2 of the 4 animals aborting, 1 farrowing normally, and 1 probably aborting. Of 3 sows mated to a boar which had received an intrapreputial injection of fresh cultures of *B. abortus*, only 1 aborted.

The average period of incubation of the organism, as judged by the date of abortion following inoculation, was 23.2 days, while the corresponding period in the 1 cow which aborted after inoculation was 58 days. Compared with the average length of the gestation period in both animals, the infectivity for both would appear to be about the same.

Tests of various methods of recognizing abortion infection in swine led to the conclusion that the agglutination test is the most reliable, although it is recognized that serological tests can not be relied upon as a means of detecting the stage of infection in sows infected in a natural manner. As judged by tests made on a few suckling pigs, only a small percentage of pigs nursed by reacting sows react to the agglutination test.

Attempts at securing immunity have been confined to studies of the effects on sows of killed and living cultures (abortion bacterin and abortion vaccine). The results with the former were contradictory. Of the latter 4 gilts which were injected subcutaneously with living cultures and bred soon after farrowed normally with one exception. That sows acquire immunity spontaneously after abortion is indicated by the breeding and farrowing records of a number of sows which had aborted as gilts. In most cases a second abortion did not occur. "These facts lead to the conclusion that the abortion disease in swine is a self-limiting infection, and that swine rapidly develop an immunity following naturally acquired infection. This augurs strongly for vaccination, especially in infected herds."

The duration of immunity following swine erysipelas vaccination, L. HOFFMANN (*Monatsh. Prakt. Tierheilk.*, 33 (1922), No. 7-9, pp. 245-257).—An experimental investigation of methods of immunizing against swine erysipelas, using white mice as subjects, is reported with the following conclusions:

The simultaneous immunization against erysipelas is in its action an active immunization. Passive immunization with serum alone is of short duration, and is recommended only as an emergency measure for infected herds. In the simultaneous immunization minimal serum and maximal culture doses should be used, since the antigen in the culture is neutralized by excessive amounts of the serum. A subsequent vaccination with increased culture dose from 10 to 14 days after the simultaneous immunization is recommended as the safest procedure, although its practice increases materially the cost of the immunization.

Insect transmission of swamp fever or infectious anemia of horses, J. W. SCOTT (*Wyoming Sta. Bul.* 133 (1922), pp. 55-137, figs. 31).—This is a report of an investigation conducted by the author, earlier accounts relating to which have been noted (*E. S. R.*, 41, p. 478; 45, p. 478), together with a review of the literature and list of 52 references. The subject is dealt with as follows: (1) general features of the disease (pp. 57-61), (2) experiments with insect transmission (pp. 61-92), (3) in reference to theories of transmis-

slon (pp. 93-96), (4) on the nature of natural transmission (pp. 96-104), and (5) suggestions in regard to control (pp. 105-107).

The investigation has led the author to conclude that there is very little danger of transmission of the disease in the absence of bloodsucking flies. As a control measure it is recommended that all horses having the disease be condemned and killed, and that the State compensate the owner for a part of this loss. This is necessary since all infected animals alive serve as carriers, and as horses are not usually of much value unless worked they can not be isolated to advantage. It is recommended that all suspected carriers, including all horses belonging to herds in which the disease has existed within a year, be kept under observation and not allowed to mingle with well horses. Ordinarily the disease is a slow-spreading one, the chronic case of healthy carrier mingling with well horses being probably the only means by which the disease is spread from one district to another or from one ranch to another.

The development of *Habronema muscae* Cart. in the house fly and of *H. microstomum* Schn. in the stable fly, E. ROUBAUD and J. DESCAZEUX (*Bul. Soc. Path. Exot.*, 15 (1922), No. 7, pp. 572-574).—This is a preliminary note on investigations conducted in continuation of those with *H. megastoma* Rud., previously noted (*E. S. R.*, 47, p. 257). It is pointed out that while *H. megastoma* develops exclusively as a parasite in the Malpighian tubes of the fly, resulting in a tumor formation of the organ, *H. muscae* and *H. microstoma* are parasites of the adipose tissue.

Tuberculosis of poultry, W. A. BILLINGS (*Minn. Agr. Ext. Spec. Bul.* 63 (1922), pp. 18, figs. 14).—This is a popular summary of information.

RURAL ENGINEERING.

The net duty of water in Sevier Valley, O. W. ISRAELSEN and L. M. WINSOR (*Utah Sta. Bul.* 182 (1922), pp. 3-36, figs. 5).—The results of seven years of experiments in cooperation with the U. S. Department of Agriculture on the net duty of water for staple crops on typical soils in the Sevier River Valley in Utah are reported in this bulletin. The experimental soils are classed as Bingham gravelly sandy loam and Redfield fine sandy loam.

Apparent specific gravity tests of the soil in its natural state showed its average weight to a depth of 6 ft. when oven dry to be 83 lbs. per cubic foot. Also nearly 52 per cent of the soil volume is pore space. The average permeability of the soil is 0.7 in. depth of water an hour; that is, free water standing on the surface of the soil will disappear at the rate of 0.7 in. per hour.

Determination of the maximum capacity of the soil to absorb and retain water showed that 1 day after irrigation it held nearly 1.5 in. and 20 days after less than 1 in. to the foot of soil in excess of the amount held before irrigation, notwithstanding the fact that evaporation had been prevented. It is therefore considered likely that 1 in. of water for each foot of soil that needs moistening is ample in a single irrigation, provided it is spread uniformly over the surface.

The crops used were sugar beets, potatoes, and alfalfa. During the greater part of the time the beet and potato plats were run in triplicate and the alfalfa plats in duplicate.

The results indicated that the application and retention on the farm of from 27 to 33 in. of water in four or five irrigations to sugar beets, of from 21 to 27 in. to potatoes, and from 30 to 36 in. uniformly distributed on alfalfa will give economical returns on these soils.

The amounts of water for the three crops above suggested include the early irrigation before seeding, but do not include the water lost from the farm through surface run-off. Measurements of surface run-off indicated that large

percentages of water are lost in spite of careful preparation of land for irrigation. The amount of water applied in a single irrigation seemed to be the most important single factor in the control of run-off, the loss for sugar beets and potatoes varying from 9 per cent with 2-in. irrigations to 28 per cent with 8-in. applications. The run-off measurements for alfalfa were smaller than for sugar beets and potatoes.

Evaporation and run-off (*Rev. Sci. [Paris]*, 60 (1922), No. 17, p. 598) -- Brief reference is made to evaporation and run-off formulas worked out by A. Coutagne and to curves constructed by means of them for run-off and evaporation in Central Europe, the United States, and central France. These curves are stated to be in practical agreement with curves obtained experimentally.

Studies of flow through cleared and uncleared floodways, C. E. RAMSER (*Engin. News-Rec.*, 89 (1922), No. 15, pp. 598, 599, figs. 2).—Investigations conducted by the U. S. Department of Agriculture in the Little River drainage district, south of Cape Girardeau, Mo., in which mid-course gaugings by means of a current meter were made in cleared and uncleared floodways for the purpose of determining the value of n in Kutter's formula, are reported.

Experiments were conducted on a straight section of a floodway about 2.5 miles in length. Two courses of 3,000 ft. each were selected along this straight section, one of which was cleared of all growth and obstructions except stumps for 500 ft. above and below the ends of the course, and the other was left uncleared below the lower end of the course and for 500 ft. above the upper end. The dimensions of the main channel in the floodway were top width 145 ft., bottom width 60 ft., and depth 20 ft.

Gaugings of the flow in the floodway were made at stations midway between the ends of the two courses. Velocity measurements were made with a Gurley-Price current meter from a boat. Four measurements were made on the cleared course for average depths in the floodway, ranging from 4.4 to 5.5 ft., and three measurements on the uncleared course for average depths, ranging from 4.5 to 4.9 ft. The average value of n obtained for the cleared course was 0.0465 and for the uncleared 0.0777. Computations with these figures showed a difference in discharge capacity between the cleared and uncleared floodways of 62.5 per cent.

Flow in Tennessee checked against hydraulic formulas, B. E. JONES (*Engin. News-Rec.*, 89 (1922), No. 15, pp. 610-612, figs. 3).—In a contribution from the U. S. Geological Survey studies of data on the flow of water in the Tennessee River and in the Irrawaddy River in India are reviewed, the purpose being to show that the slope and hydraulic radius, through their influence on velocity, do affect the value of the coefficient C , or, more accurately, that the Ganguillet and Kutter formula does not fully allow for the effect of slope and hydraulic radius on the coefficient C . For both rivers it was found that for velocities up to 2.5 to 3 ft. per second an increase in slope is accompanied by an increase in the coefficient C . For higher velocities C tends to decrease as the slope increases. On the Tennessee River, for higher velocities C increased with the hydraulic radius, although the slope remained constant or even decreased. On the Irrawaddy River, C remained fairly constant although both the slope and hydraulic radius increased.

These results are taken to indicate that the assumptions that C in Chezy's formula does not vary with the slope and that C in the Ganguillet and Kutter formula increases with the slope when the hydraulic radius is less than 1 meter and decreases as the slope increases when the hydraulic radius is greater than 1 meter are both wrong under certain conditions.

An investigation of the Herschel type of weir, R. H. MORRIS and A. J. R. HOUSTON (*Mech. Engin.* [New York], 44 (1922), No. 10, pp. 651-654, figs. 8).—Studies to determine the effect of the degree of smoothness of the crest and slopes, radius of the crest, position at which the upstream measurement is made, increasing or decreasing the velocity of approach, and changing the position of the orifices in the crest on the action of the improved type of weir designed by Herschel for gauging in open channels (*E. S. R.*, 42, p. 681) are reported.

It was found that all these factors affected the discharge to some extent. Friction greatly affected the discharge, causing a variation as great as 12 per cent. The formula for the discharge was materially affected by the size of the pipe forming the crest. Each size of the crest has definite limits between which the discharge varies as a straight-line function. Upstream measurements taken with three gauges were identical below about $3\frac{1}{2}$ cu. ft. per second per foot length of crest. Above that quantity the gauge nearest the crest showed a slight drop, indicating that the upper-surface curve extended at least 6 ft. upstream from the crest.

It was further found that the velocity of approach can not be corrected for by means of the simple formula $V^2/2g$. The velocity of approach was increased nearly 300 per cent, with a corresponding difference of about 7 per cent in the corrected discharge.

It is concluded that when a weir of the Herschel type is properly constructed there is a constant ratio between the quantity of water passing over the weir and the difference in the two observed pressures. "However, so many are the determinant factors, and so great is their influence upon the discharge formula, that a weir of this type, in its present state of development, would probably be valueless unless calibrated by actual tests. It is believed that further extended research may remedy this difficulty. Probably the chief advantage of the new weir lies in the fact that for the same upstream head it discharges about 20 per cent more water than the ordinary type of weir."

Anomalous results in Venturi flume and meter tests, W. J. WALKER (*Engin. News-Rec.*, 88 (1922), No. 19, pp. 797, 798, fig. 1).—A discussion is given of the peculiar variations of Venturi coefficients of discharge.

Irrigation enterprise in India, F. W. WOODS (*Jour. Roy. Soc. Arts*, 70 (1922), Nos. 3641, pp. 705-718; 3642, pp. 719-730, figs. 13).—This is a review of the general hydraulic features and of some of the economic features of irrigation engineering work in India.

Administration report with statistical statements and accounts for 1920-21, Irrigation Department, Punjab (*Punjab Irrig. Dept. Admin. Rpt. 1920-21*, pp. [193], pls. 20).—This report contains data on areas irrigated by Punjab canals under both major and minor works, together with a statement of the financial results obtained from these canals for the year 1920-21. A review of the work of the Irrigation Department of the Punjab for the year 1920-21 is also included.

Nile control, M. MACDONALD (*Cairo: Egypt Min. Pub. Works*, 1921, 2 ed., vol. 1, pp. XVI+304, pls. 8).—This is the second edition of this book, which comprises a statement of the necessity for further control of the Nile to complete the development of Egypt and develop a certain area in the Sudan, with particulars of the physical conditions to be considered and a program of the engineering works involved.

Colorimetric test for concrete sand studied, C. E. PROUDLEY (*Engin. News-Rec.*, 89 (1922), No. 15, pp. 617, 618).—In a contribution from the U. S. Department of Agriculture results of studies of the standard test for organic impurities in 100 normally graded sands are reported.

The data on the apparent effect of organic matter on the strength ratio at 7 days showed that of the total number of sands considered there were only 32 which failed to show 100 per cent strength ratio. Fifty-six per cent of those below 100 per cent strength ratio were found to contain objectionable minerals, while less than half that number were found among those of higher strength ratio. Eighty-three of the sands showed satisfactory color and the other 77 were subject to doubt, but of the 83 good sands 8 were found to be low in strength and of the 77 doubtful sands 53 were really satisfactory. These results were taken to indicate that this test is much more likely to cause the rejection of a satisfactory sand than the recommendation of an unsuitable sand.

Studies of the apparent effect of organic matter on the strength ratio from 7 to 28 days showed that more of the sands decreased in strength ratio than remained constant. This is taken to indicate that a certain amount of consideration for the possible reduction in strength ratio at 28 days should be given. It is emphasized, however, that the peculiarities of the district from which a sand comes should not be overlooked. "Large areas are sometimes supplied with materials which, if use depended upon the indications of organic matter, would never build concrete roads. As has been pointed out, there are many sands of good quality showing a dark colorimetric test. On the other hand there are regions in which a testing engineer can safely prophesy the tensile strength ratio by reference to mechanical analysis and color. Still others never find organic matter in their sand even though they experience the usual difficulties with the strength. Thus, the dependability of the test is best judged by those who use it according to the circumstances involved."

Plain concrete for farm use, T. A. H. MILLER (*U. S. Dept. Agr., Farmers' Bul. 1279* (1922), pp. 11+27, figs. 19).—This discusses the requirements of good concrete, and describes the making and placing of plain concrete.

Manufacture and installation of precast lock-joint concrete pipe, compiled by W. H. NALDER (*Reclam. Rec. [U. S.], 13* (1922), No. 9, pp. 223-228, fig. 1).—Technical information on the design, manufacture, and installation of precast lock-joint concrete pipe, as practiced on projects of the U. S. Reclamation Service, is presented.

Portland cement concrete roads, J. T. VOSHILL and R. E. TOMS (*U. S. Dept. Agr. Bul. 1077* (1922), pp. 67, pls. 10, figs. 15).—This bulletin presents technical information on the design and construction of concrete pavements for the use of highway engineers and others. Information is also included on organization, and equipment, capital required, cost of concrete pavements, maintenance, and resurfacing.

Highway transport and its relation to the public (*New York: Natl. Auto. Chamber Com., Inc., [1922], pp. 40*).—This is a brief discussion of motor traffic and road construction in the United States, with a glimpse into some of the major problems ahead. Extracts are included from contributions of the U. S. Department of Agriculture.

Report of the Louisiana Highway Commission, W. T. PETERMAN ET AL. (*La. Highway Comm. [Bten] Rpt., 1* (1921-22), pp. 99, figs. 6).—This is the first report of the Louisiana Highway Commission for the biennium ended April 20, 1922. It deals with the work and expenditures and revenues collected by the commission in Louisiana during the period.

Potato digger tests (*Impl. and Mach. Rev., 48* (1922), No. 570, pp. 748-752).—Comparative studies under service conditions of a number of different types of potato digger are reported, the purpose being to establish the require-

ments of a successful potato digger and the relative efficiencies of different types of machines.

A preliminary study of the operation of potato lifters indicated that a successful machine must bring the potatoes well to the surface, leave them well exposed and undamaged, and the draft of the machine must be comparatively light. The rotary or spinner type of machine gave in general the best results. It is concluded that the general principal of the rotary machine is sound, but that further research is necessary into the problems of speed, angle of tine, projecting load, and the resultant effect on the potatoes, as well as the ease of digging. When the 10 machines were arranged in order of merit according to costs, all of the seven rotary types were included in the first seven, while when arranged in the order of merit according to mechanical efficiency, the first six were of the rotary type.

It was found that the advantages of a low speed gear and an angle of tine of 45° in a rotary machine were reflected in the smaller proportion of damaged potatoes and the small number left in the ground. The use of a properly adjusted screen was also beneficial. It is emphasized that the lowest quantity of damaged potatoes was caused by a sharp initial curve in the tines. The fastest moving machines threw the potatoes the farthest. The drawbar load of a rotary machine was affected by the weight of the machine, the line of draft, depth and pitch of share, and the power absorbed in the transmission gearing. The number of tines did not affect the draft to any appreciable extent. With the elevator types of machine the drawbar load was affected by the line of draft, the depth and pitch of the share, and the transmission.

Controlled curing of tobacco as means to meet present day demand, A. C. BUENSON (*Tobacco*, 74 (1922), No. 22, pp. 45-47, figs. 6).—Control methods and apparatus for curing tobacco are described and illustrated in this report.

Convenient farm homes, L. J. SMITH, R. WEAVER, and M. M. LAWRENCE (*Wash. State Col. Ext. Bul.* 91 (1922), pp. 17, figs. 17).—The details of floor plans for 12 farm homes are presented in this bulletin. There are said to be prize plans entered in the convenient-farm-home competition conducted by the Washington State College in cooperation with the American Institute of Architects.

Pisé-de-terre, P. B. AIRD (*Union So. Africa Dept. Agr. Jour.*, 5 (1922), No. 3, pp. 268-275, figs. 7).—Illustrations and detailed descriptions of the construction of pisé-de-terre farm buildings are presented.

The preservation of decaying wood roofs, W. S. BROWN (*Mech. Engin.* [New York], 44 (1922), No. 11, pp. 709-712, figs. 6).—This is an analysis of the general theory of wood decay, the cause of decaying wood roofs, and methods employed in preserving wood roofs.

It is stated that in wood roof decay the so-called damp rot group of fungi is to be considered. Decay in roofs is usually greatest in planks and beams at bearings because, due to the additional insulating properties of the supporting members, the locus of moisture condensation dips. Tops of roof rafters and girders rot first, and, other conditions being equal, decay is more active in the vicinity of ventilators and cold conductor pipes.

In the case of existing roofs the treatment must of necessity be ameliorative rather than preventive or curative. The treatment consists in removing the water supply from the fungus causing wood decay by preventing condensation as far as is practicable. It has been found that condensation is decreased by insulating the outer roof surface, the extent of inhibition depending upon the amount of insulation. Top insulation has the effect of moving the

plane or locus of condensation for any given set of atmospheric conditions nearer the outer surface of the plank than before, and in mild weather of eliminating it entirely.

Economic considerations in prolonging the useful life of repaired roofs are also presented.

RURAL ECONOMICS AND SOCIOLOGY.

A graphic summary of American agriculture based largely on the census of 1920. O. E. BAKER (*U. S. Dept. Agr. Yearbook 1921*, pp. 407-506, figs. 124).—The first part of this study is devoted to a series of maps visualizing in a very generalized way the agricultural regions of the United States and the topographic, climatic, and soil conditions which determine them, also the location and extent of the land available for reclamation by irrigation, by drainage, and by clearing of forest growth. Two graphs are given, one outlining the trend of land utilization in the past, the other tentatively stating the limits of the expansion of our arable area in the future. The second part shows the geographic distribution of 50 crops in the United States according to the census of 1920. The third part consists of a series of 24 maps showing the geographic distribution of the several kinds of live stock, total and pure-bred only, and of the production of butter and cheese, wool, and mohair. The last section considers the farm as a whole, indicating on maps the variation in size and value of the farms in different portions of the United States; expenditures for labor, feed, and fertilizer; ownership and tenancy; and the geographic distribution of country, village, and city populations. Four small maps are also given showing the number of farms having automobiles, tractors, telephones, and running water in the house, as reported by the census for January 1, 1920.

The corn crop. C. E. LEIGHTY, C. W. WARBURTON, O. C. STINE, and O. E. BAKER (*U. S. Dept. Agr. Yearbook 1921*, pp. 161-226, figs. 51).—The importance of the corn crop of the United States is indicated by the fact of its greater value than the combined values of the wheat and cotton crops. Corn production in the world and in the United States, the history and location of this industry in the United States, methods of handling, and environmental factors determining the acre yield are described.

Very little borrowed capital is used in the production of corn. A considerable amount, however, obtained directly from the banks is used in converting corn into pork and beef, this being the most important method of marketing the crop.

Costs of production are discussed and graphically presented. In considering the commercial movement of corn and some of the factors that influence and determine corn prices, the subjects of quality and grading, surplus and deficiency of corn in different areas, monthly marketings, moisture content and shrinkage in storage, exports and imports of the United States and Argentina, and freight rates are discussed.

Fluctuations in prices and in the purchasing power of corn are traced. It is pointed out that the purchasing power of corn in terms of the 1913 dollar did not rise until 1917. In 1920 it suffered a sudden drop, and in 1921 it was far below that of any other year.

Corn does not enter into international trade to such an extent as does wheat. The price is determined largely by the Chicago market, which is the most important one for corn in the world. The future demand for corn is held to depend mainly upon the demand for meat, and if present standards of living are maintained a greater corn production will be necessary.

The cotton situation, A. M. AGELASTO, C. B. DOYLE, G. S. MELOY, and O. C. STINE (*U. S. Dept. Agr. Yearbook 1921*, pp. 323-406, figs. 53).—Shifts in cotton production in the United States through a number of years are traced and mapped. The soil, climate, crop combinations, and general farm practices in the Cotton Belt are described, and the ravages of the boll weevil, pink bollworm, and other cotton pests and diseases are set forth from the economic point of view. Considerable cost of production data from surveys and studies made in 1918 and 1919 are reviewed, and an example is worked out of a form for figuring costs per acre of cotton and per pound of lint.

The trend of farm wages and the cost of articles farmers buy compared with the December 1 price of cotton, 1910 to 1921, as presented here indicates that the price of cotton fell to a low point in 1914, rose to high points 1917 to 1919, and fell precipitously to a low point in 1920. Wages and prices of articles that farmers buy rose less rapidly in the period of inflation and fell more slowly with deflation.

The production of cotton in the United States rests upon credit to a rather unusual extent compared with most other agricultural products. The chief agencies from which this credit is obtained by the cotton farmer are the bank, the merchant, and, in the case of tenants, the landowner. Prevailing rates of interest and forms of personal and collateral security and terms of loans are noted.

A résumé is given of cotton handling and marketing from ginning to grading, warehousing, and buying and selling on the markets. It is said that approximately one-half of the crop is consumed in this country and the remainder is exported. Statistics of supply and consumption are tabulated and presented in graphs.

Wheat production and marketing, C. R. BALL, C. E. LEIGHTY, O. C. STINE, and O. E. BAKER (*U. S. Dept. Agr. Yearbook 1921*, pp. 77-160, figs. 72).—The relative importance of the wheat crop of the United States, world production, and trends and the history of the development of wheat growing in the United States, as well as the outstanding cropping systems to which it belongs, are described and illustrated.

Some of the conditions affecting the relative profitableness of crops and the factors governing the proportionate acreage of different crops in any given section are said to be the economic distribution of labor on the farm throughout the year and competition between crops for land. Total farm profits may be greater if some wheat acres are given to other crops. The limiting factor to the size of the wheat crop is usually the precipitation of the region.

Data on net cost of wheat per bushel in 1919 and on regional variation in cost of production and in cost factors are presented graphically. The six commercial classes of wheat under the United States Official Wheat Standards are described, and the estimated acreage of each in 1919 is illustrated by a series of maps. The average quality of the wheat crop according to estimates for 22 years, 1900 to 1921, and the annual variation in quality as indicated by classes and grades at all inspection points July, 1917, to June, 1921, are graphically presented. Wheat storage and movement and freight rates are covered briefly. Farm and market prices are traced by class, subclass, and grade.

It is attempted to summarize the long-time trends in production and trade and consumption. Per capita consumption is shown to have increased from 3.8 bu., the average of 1839 and 1849, to 4.9 bu. as the average from 1875 to 1884, and to 5.6 bu. as the average between 1905 and 1914.

Our beef supply, E. W. SHEETS, O. E. BAKER, C. E. GIBBONS, O. C. STINE, and R. H. WILCOX (*U. S. Dept. Agr. Yearbook 1921*, pp. 227-322, figs. 76).—

Geographic phases of the production of beef cattle are discussed and presented on dot maps. Areas of beef production and regions where feeds are grown in the United States, as well as statistics of various classes of beef cattle, are described and mapped. The four principal factors making up the cost of producing beef cattle are given as the initial cost, operating expenses, building and equipment charges, and interest on capital invested. Cost figures covering the raising and fattening of cattle showing quantities of feed, pasture, and labor necessary in keeping a breeding herd and in producing yearling feeder steers are presented here for cattle in the Corn Belt. Statistics of market receipts and of cattle slaughtered are mapped and presented in graphs. The discussion of prices is based mainly upon quotations on the Chicago market.

A study of monthly average prices of good beef cattle from 1901 to 1921 develops the fact that during the first seven years of this period the market was relatively steady. Beginning with August, 1901, prices moved upward and continued in that direction for about a year. The peak was reached in July, 1902, steadily advancing until in 1915 a strong upward movement began which, with several sharp recessions, continued until August, 1919, when the average price of good beef steers was \$16.45 per 100 lbs., or an increase of nearly 274 per cent above the low point in December, 1904. In September, 1920, liquidation began in earnest, and with only slight recoveries the market continued downward to the end of 1921.

Since corn is such an important factor in the production of beef, the price of beef cattle is presented in terms of bushels of corn covering a 12-year period from 1910 to 1921, inclusive. A wide variation from time to time is indicated in the relative values of beef cattle and corn. When corn is relatively high cattle feeders are inclined to sell corn, but when it is relatively cheap higher return is sought by feeding to cattle. A comparison of cattle prices with their purchasing power in terms of general commodities from 1878 to 1921 shows that up to 1912 cattle were relatively higher in price than other commodities. From that time until 1914 they were about equal, but the purchasing power began to decrease, and from 1915 to 1919, while cattle prices had a sharp advance, it did not equal that in price of general commodities. From 1919 through 1921 both cattle prices and purchasing power had a sharp decline, but up to the end of 1921 the purchasing power of cattle was still considerably below the actual price.

U. S. Department of Agriculture standard grades for cattle are noted. Beef consumption and trends of production are statistically and graphically presented.

Unit requirements for producing market milk in Delaware, J. B. BAIN and R. P. HORIS (*U. S. Dept. Agr. Bul. 1101 (1922)*, pp. 16).—Records were obtained by regular monthly 24-hour visits to 15 farms in 1919-20 and 16 in 1920-21. Computed on the basis of the number of cows kept in the herd for 12 cow months, the first year's study included 248.7 cows, with an average yearly production of 5,556 lbs. of milk averaging 3.6 per cent of butter fat. The second year's study included 281.6 cows, with an average yearly production of 5,826 lbs. of milk and an average butter fat test of 3.6. The Holstein breed in both grade and purebred animals far outnumbered all the other breeds combined. A few Guernseys and Jerseys were found.

The requirement items tabulated include feed, bedding, and pasture, human and horse labor, and other costs, which were building and equipment charges, herd charges for taxes, insurance, veterinary service, and medicines, interest on the cow investment, cost of keeping a bull, motor truck charge, and cash hauling of milk. These are tabulated per 100 lbs. of milk produced in winter and in summer and per cow kept during each season and for the entire year.

The credits for calves and manure for the entire year amounted to 18.2 per cent of the total cost of production, whereas labor amounted to 16.7 per cent, and other costs, including depreciation on the herds, 30.3 per cent. In other words, calves and manure failed by a small margin to equal the labor cost and by a wide one to balance the other costs.

The net cost, quantity, and percentage of milk produced by each herd during two winters and two summers are tabulated in an ascending scale. For the first winter 84.7 per cent of the milk was produced at \$3.88 or less per 100 lbs. The schedule of costs for the second winter shows a sharp increase in price after 84.1 per cent of the volume of milk was produced. At \$4.96 only 6.7 per cent more milk was produced, but at an increased cost of 95 cts. per 100 lbs.

Summary of requirements for producing milk in Delaware, 1920-21 and 1921-22.

Item.	Per 100 pounds of milk.		Per cow.
	Winter	Summer	Weighted average, entire year.
Total concentrates..... pounds..	53.7	15.5	1,885
Total dry roughage..... do.....	114.2	6.5	3,289
Silage and other succulents..... do.....	91.0	10.3	2,760
Bedding..... do.....	17.9	3.4	578
Hauling and grinding grain.....	\$0.01	\$0.002	\$0.34
Pasture.....	\$0.06	\$0.48	\$14.68
Human labor..... hours.....	2.6	2.5	140.1
Horse labor..... do.....	0.5	0.4	21.8
Total other costs, except depreciation on cows.....	\$0.70	\$0.75	\$42.34
Depreciation on cows.....	.24	.23	12.59

Of the cost of producing milk 53 per cent is attributed to feed, bedding, and pasture. The average costs of producing milk were \$3.36 and \$3.70 per 100 lbs. for the two winters, respectively. The costs for the two summers were, similarly, \$2.40 and \$2.19.

Why costs of milk vary, P. E. McNALL and D. R. MITCHELL (*Wisconsin Sta. Bul.* 345 (1922), pp. 24, figs. 4).—Records from the producing herds on 24 dairy farms at Oconomowoc and Summit in Waukesha County, Wis., varying in number of cows from 8 to 28 and averaging 16, were taken as the basis of this study by the station and the State Department of Markets, cooperating. Four of the herds were purebred, 10 were part purebred and part grade, and 9 were all grade. Seventeen were Holstein, 4 Guernsey, 1 Jersey, and 2 were of mixed breeds. The data were collected by the dairy accountant in charge of the regular cow-testing work, who did the testing and collected cost data from each farm each month.

The average cost per 100 lbs. for the year ended August 31, 1921, was \$3.02, ranging from \$1.88 in May to \$4.01 in November, and from \$2.61 for the six summer months to \$3.40 for the six winter months. Feed and bedding were the most variable of the three costs, showing the maximum variation of 9.9 per cent, while labor varied 3.6 per cent and other costs 6.3 per cent. Feed and bedding amounted to an average of 54 per cent of the net cost for the year, ranging from 39.2 per cent in June to 62.8 per cent in November. Expressed in money terms, milk was produced 72 cts. per 100 lbs. cheaper for feed in the summer than in the winter. Labor expense was found to be much less variable than feed. The rather sharp rise in September was due to the small volume of milk produced. Variations in cost other than feed, bedding, and labor are due to changes in credit items or abnormally high costs of one kind or another.

The net cost of keeping a cow for the year was \$215.25, of which \$116.66 was for feed and bedding, \$56 for labor, \$42.59 for other costs. The winter costs were \$127.41, compared to \$87.84 for the summer.

It was found that 63.8 per cent of the milk was produced at average cost or less. Production was found to be the greatest factor influencing costs. When the herds were arranged in the order of their average milk production per cow into three equal groups containing, respectively, the 8 herds of lowest, medium, and highest average production per cow, the concentrate requirements per cow for the various groups were proportional to the milk yield. When the yearly requirements for these groups were reduced to the requirements for 100 lbs. of milk, it was significantly indicated that the higher producing cows showed marked economy in all items except concentrates. The total difference between the highest and the lowest producing groups was \$1.18 per 100 lbs., group 2 producing milk 81 cts. per 100 lbs. cheaper than group 1. It is shown that group 3 in spite of heavier feeding of grain and added costs per cow produced milk cheaper by 37 cts. per 100 lbs. than did group 2.

It is concluded that the concentrate ration could profitably be increased to that point where the cost of the last increase of grain would just equal the saving on the fixed charges, such as roughage, labor, and housing due to the increased milk flow.

[**Economic and crop conditions on the Yuma Reclamation Project Experiment Farm in 1919 and 1920**], E. G. NOBLE (*U. S. Dept. Agr., Dept. Circ. 221* (1922), pp. 5-12, 13, 14, fig. 1).—A tabulated summary is given of irrigation development on this project during the 9-year period 1912 to 1920, inclusive. Tabulations are given showing also the yields and farm value of crops grown in 1919 and 1920; the acreage, production, and farm value of the principal crops grown in the 10-year period 1911 to 1920, inclusive; and an inventory of live stock on hand at the close of each year of the same period.

[**Cost of production on the North Dakota demonstration farms**], E. I. OLSEN (*North Dakota Sta. Bul. 163* [1922], pp. 4-51, 53, 54).—The records submitted in the sixteenth annual report of the 20 demonstration farms in North Dakota for the crop year 1921 were furnished by the managers of the farms. Costs and income for specific crops and for each of the farms are tabulated, with analytical notes. An earlier report was noted (*E. S. R.*, 45, p. 293).

[**Farm lands available for settlement**], B. HENDERSON (*U. S. Dept. Agr., Farmers' Bul. 1271* (1922), pp. 11+51, figs. 11).—Information concerning the various sections of the United States where farm lands are still open to settlement has been brought together here, covering the cut-over, drainable, irrigable, and dry-farming and grazing lands by important districts where they are located. They are described and mapped, and the cost of clearing and subdividing a farm is estimated. Acquisition by homesteading or by the purchase of State and school lands, Carey Act land, Indian lands, and railroad and other large tracts of undeveloped land held by private agencies is briefly considered. A list of State immigration bureaus, State officers in charge of State lands, States publishing lists of farms for sale or rent, and Indian land subject to sale or lease, 1922, is given in an appendix.

[**Renting dairy farms**], H. A. TURNER (*U. S. Dept. Agr., Farmers' Bul. 1272* (1922), pp. 24).—Field studies were made in Jefferson and Montgomery Counties, N. Y.; Salem, Sussex, and Warren Counties, N. J.; Clinton County, Mich.; Kane County, Ill.; Green County, Wis.; and, to a smaller extent, in other counties in these and in other States to ascertain conditions under which dairy farms are rented. Recourse was had also to the tenant records taken on share-rented dairy farms in connection with farm management surveys previously noted (*E. S. R.*, 34, p. 502; 38, p. 877; 39, p. 689).

The discussion is devoted mainly to customary practice in renting dairy farms for half of all receipts. Land, buildings, and fences are furnished by the landlord, who usually pays the taxes against the real estate and provides the materials for fence repairs. Man labor is almost always provided by the tenant. Work animals are furnished by the tenant, and farm machinery and tools usually, but by no means invariably. The landlord owns half or more than half of the cows where a large herd is kept. He frequently owns it entirely when a tenant first comes on his farm. The tenant usually has a half interest in stock raised. Receipts from sale of milk and crops are shared equally. Upon a change in tenants the jointly owned live stock is commonly divided into two lots as nearly equal as possible, either one of which the landlord is privileged to choose. Usually tenants are required to buy a half interest in the grain on the farm when they come or supply an equal amount when they leave. Half the grain remaining is theirs. Variations and exceptions to the rule are noted.

On share-rented farms in the Northeastern States, of which dairying is incidental to crop farming, it is usual for the tenant to furnish the labor, the farm machinery, the horses, and all other live stock as well. The tenant gets all of the receipts from the live stock and half of the crops, but he must feed his horses and other live stock from his own share of the crops or buy feed for them.

The smaller and inferior farms offered for rent are usually taken on a cash-rent basis. On cash-rented farms on which the receipts are largely derived from sales of dairy products the rent can ordinarily be conveniently paid out of the milk check if the payments are distributed fairly evenly over the year or that part of the year when most of the milk is sold.

The bulk handling of grain, with special reference to the Pacific Coast States. E. N. BATES and A. L. RUSH (*U. S. Dept. Agr., Farmers' Bul. 1290 (1922), pp. 22, figs. 17*).—The chief advantages of bulk handling are the saving of time and labor, the reduction in the cost of handling, the elimination of the cost of the bags, the prevention of waste from leaky bags, the ease and accuracy of inspecting the grain, and the convenience with which bulk grain can be conditioned and cleaned.

The necessary farm and elevator equipment for handling bulk grain, particularly in the Pacific Coast States, is described, as well as farm storage facilities, such as bins, permanent granaries, and farm elevators.

Weather, Crops, and Markets (*U. S. Dept. Agr., Weather, Crops, and Markets, 2 (1922), Nos. 19, pp. 393-408, figs. 2; 20, pp. 409-424, figs. 4; 21, pp. 425-456, figs. 3; 22, pp. 457-480, figs. 3*).—These numbers contain for the weeks ended October 31 and November 7, 14, and 21, 1922, the usual weekly notes on the weather and its relation to crop conditions, with temperature and precipitation maps, and statistical reports on market receipts, prices, and the position in the market of important products and classes of crops and live stock, together with special articles on market conditions. The November crop report submitted in No. 21 is devoted mainly to the estimated production and condition of the 1922 corn crop. A condensed summary of production, yield per acre, quality, and farm price of important crops up to and including November 1 is given. The report on estimated crop conditions November 1, with comparisons, is given by States, as are also the usual estimated farm value of important products and averages of prices received by producers. Data summarizing the monthly forecasts of production of certain crops, 1912-1922, with preliminary and final estimates, are tabulated.

[Yearbook statistics of crops and live stock production and trade] (*U. S. Dept. Agr. Yearbook 1921, pp. 71-76, 507-845*).—U. S. Department of Agriculture statistics of grain crops, crops other than grain crops, farm animals and

live stock products in the United States and in foreign countries in 1921, with summaries for earlier years, and data as to the Federal meat inspection are tabulated. Compilations are given of exports and imports of agricultural products. Miscellaneous statistics include among other items crop summaries, harvesting and planting dates, prices of things farmers buy, wages of farm labor, and implements and equipment used, etc. Various cost data have been assembled and in most cases are comparable. Live stock figures are comparable, excepting those for dairy cows. The data on cost of tractors, motor trucks, sugar beets, beans, cotton, potatoes, tobacco, grain sorghums, and apples are comparable for the various regions concerned.

AGRICULTURAL EDUCATION.

Status of the rural teacher in Pennsylvania, LE R. A. KING (U. S. Bur. Ed. Bul. 34 (1921), pp. IV+87, figs. 6).—This study was made in an endeavor to collect data with regard to the personal, social, and economic status of teachers in the one-teacher schools in the open country, conditions under which the work is conducted, academic and professional preparation and training, certification, experience in teaching and tenure, and salary. Questionnaires were distributed during the school year ended with June, 1918, among the one-teacher rural schools of 18 counties of the State selected at random, except that special precaution was taken that the eastern, central, and western sections should be represented. Replies were received from 1,450 teachers, of whom 1,110 were women and 340 men. Of these 45 per cent hold provisional certificates, 24.7 professional, 12 permanent, 18 normal school certificates or diplomas, and approximately 0.3 per cent college provisional or permanent certificates. Aside from the data derived from replies to the questionnaires, additional information was obtained from county superintendents and from the principals of 13 State normal schools. Certain other data from secondary sources were used to a limited degree.

Investigation of the working conditions of rural teachers shows that their schools range in size from 3 to 68 pupils, with an average of 26. The median number of class recitations is 25.6, varying from 9 to 50 per day, and 25 per cent of the teachers have school programs of 30 or more recitations per day. Only 31 per cent of the schools have libraries containing from 10 to 400 volumes, but 43 per cent of the rural teachers have access to other libraries. The teachers are supervised only from 15 minutes to 8 hours per school year, and the superintendent makes on an average one visit each year of from 30 minutes to 1 hour. Only 28 per cent of the teachers reported parent-teachers' organizations or any other type of community activity in connection with their schools.

The academic and professional training was found to be comparatively low. Of this group 76 per cent had no normal school training, and of the remaining 24 per cent which had attended a normal school for periods ranging from 6 weeks to 4 years in length, only 18 per cent completed the course.

Examination of the certificate situation of five typical counties over a period of three years, 1917 to 1919, showed a tendency toward marked increase in the number of provisional certificates and a consequent decrease in the number of normal school certificates.

The experience of teachers in the one-teacher rural schools average 3.7 years. The average experience for men teachers is 7 years and for women teachers 3.2. It is estimated that there will be required in this State each year between 5,000 and 6,000 new teachers, which makes it imperative that additional training facilities be provided.

The salary situation explains in a large measure the instability of the teaching force among the smaller villages and rural districts.

A suggestive empirical analysis of the work of the teacher of vocational agriculture in the public high school, T. H. EATON (*Vocat. Ed. Mag.*, 1 (1922), No. 4, pp. 258-261).—A tentative outline of some of the jobs of the teacher of agriculture in the vocational department of the public high school is presented here, as drawn up by a group of graduate students in teacher training at Cornell University.

Part-time cooperative courses, C. F. KLINEFELTER (*Fed. Bd. Vocat. Ed. Bul.* 78 (1922), pp. 29).—The part-time cooperative course is one designed to meet the needs for trade preparatory training in communities ranging in size from the small city of 8,000 to 10,000 population to the largest cities. Its organization does not disrupt the existing public school organization, but merely adds another course to the curriculum. A large number of boys who would otherwise enroll in the commercial course of the high school prefer the part-time courses. They may be established in a community on such a basis as to be open to pupils as soon as they reach the age for securing an employment certificate. It has been demonstrated, however, that a large percentage of the pupils will be held in such a course for several years beyond the period at which they would otherwise have severed all connection with the regular school program. Enrollment should not be restricted only to those who have had two years of high school work. Cooperative courses are true part-time courses in that they offer technical, related, and academic instruction during part of the working day of pupils employed regularly in industry, and they are based upon a close cooperative working relationship between the industries and the public school.

The advantages and disadvantages of the two shift half-day-about plan and the two-week-about or month-about plan are discussed. A typical course of study for a two-year course is drawn up. A suggested curriculum, including English, shop mathematics, trade sciences, mechanical drawing, coordination between theory and practice, and industrial history, is set up and discussed at length.

Measuring results in home project work, C. COLVIN (*Vocat. Ed. Mag.*, 1 (1922), No. 4, pp. 261-264).—The seven elements of plan, record, efficiency in performance, economic income, skills, knowledge, and attitude were concluded to be important in home project work, and 260 teachers of vocational agriculture gave them the relative importance of the average scores of 16, 13, 19, 10, 12, 15, and 15, respectively.

The use of a standard score card is recommended as a guide in teaching. Two problems presenting themselves for future study are the establishment of objective standards of excellence wherever possible and the correlation of each of the elements named with general merit in the project and with each other. The complete score card for judging the success or failure of pupils in home projects, with a form for a summary record of the project, is given.

Home economics education: Organization and administration, J. T. BERRY and A. E. RICHARDSON (*Fed. Bd. Vocat. Ed. Bul.* 28, rev. ed. (1922), pp. V+52).—This bulletin is a revision of one previously noted (*E. S. R.*, 41, p. 494).

Self-supporting home economics departments, H. W. CALVIN (*U. S. Bur. Ed., Home Econ. Circ.*, 15 (1922), pp. 6).—This discussion is largely confined to the problems of preparing lunch in small schools. Suggestions are made as to the preliminary work of arranging a course in foods to function with the lunch service. This is to be followed by the preparation of theory lessons intended to develop a knowledge of elementary nutrition and dietetics, of proper food combinations, and of the production, marketing, and care of food, with spe-

dial emphasis upon sanitary practices. The preparation of the larger recipes from experiments with small quantities is recommended. Suggestions are also made as to the cooperation of other teachers in serving hot foods.

An agricultural school for young girls, H. SAGNIER (*Jour. Agr. Prat.*, n. ser., 38 (1922), No. 28, pp. 53-56, figs. 5).—A school at Gometz-le-Châtel (Seine-et-Oise), France, providing both theory and practice in a number of farming operations, is described here.

Productive farming, K. C. DAVIS (*Philadelphia and London: J. B. Lippincott Co., 1922, 5. ed., rev. and enl., pp. VIII+403+XXIX, pl. 1, figs. 252*).—In this edition of a textbook previously noted (*E. S. R.*, 44, p. 794), the chapter on swine has been rewritten, enlarged, and adapted to home-project methods. To the chapters on sheep and poultry have been added matter on projects, debates, and contests, and new references are given.

Tropical agriculture for rural schools, S. D. W. MILLS and A. DOMÍNGUEZ NIEVES (*Nociones de Agricultura Tropical para las Escuelas Rurales. Boston and London: D. C. Heath & Co., 1922, pp. XXVI+373, figs. 207*).—This is a textbook for Spanish-speaking countries in the West Indies, prepared with the editorial assistance of J. Padlin. It gives briefly some elementary principles of botany, and then describes the best methods of cultivating the principal crops of these regions and pests and diseases to be combated in growing them successfully.

A course to train specialists in agronomy, D. W. ROBERTSON (*West. Canad. Soc. Agron. Proc.*, 2 (1921), pp. 15-19).—An outline is given arranging subject matter under the special group headings of crops, soils, and plant breeding, with the distribution of credit hours for each. Prerequisites for agronomy subjects and the distribution of studies in a four-year course are included in this report.

Poultry judging for use of Virginia boys' and girls' poultry club members, A. L. DEAN (*Va. Agr. Col. Ext. Bul. 75 (1922), pp. 34, figs. 35*).—Steps to follow in judging poultry are outlined, and suggested charts are given for scoring a number of the important breeds.

Twenty lessons on dairying for dairy club members, F. A. BUCHANAN (*Va. Agr. Col. Ext. Bul. 72 (1922), pp. 74, figs. 8*).—This bulletin presents an outline on the care of the dairy cow, dairy rations, the production of clean milk, the showing and judging of dairy cattle, and diseases and parasites.

Reference manual for the selection, construction, and care of clothing, E. OLIVER (*Va. Agr. Col. Ext. Bul. 77 (1922), pp. 51, figs. 13*).—This is a brief reference manual for use in studying the recognition and selection of clothing textiles, the simple constructive processes involved in garment making, and the general care of clothing.

MISCELLANEOUS.

Yearbook of the Department of Agriculture, 1921, H. C. WALLACE ET AL. (*U. S. Dept. Agr. Yearbook 1921, pp. V+885, figs. 397*).—This contains the report of the Secretary of Agriculture; five special articles abstracted elsewhere in this issue; and the usual statistics, noted on page 294.

The work of the Yuma Reclamation Project Experiment Farm in 1919 and 1920, E. G. NOBLE (*U. S. Dept. Agr., Dept. Circ. 221 (1922), pp. 57, figs. 11*).—This report includes a summary of meteorological observations from 1911 to 1920, a review of agricultural conditions on the project, and a report of the work on the experimental farm during 1919 and 1920. The experimental work reported is for the most part abstracted elsewhere in this issue.

Annual Report of Florida Station, 1921, W. NEWELL ET AL. (*Florida Sta. Rpt. 1921*, pp. 33+III).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1921, a general review of the work of the station during the year, and departmental reports, the experimental features of which are for the most part abstracted elsewhere in this issue.

Thirty-fourth Annual Report of Michigan Station, 1921, R. S. SHAW ET AL. (*Michigan Sta. Rpt. 1921*, pp. 151-636, figs. 99).—This contains a financial statement for the year ended June 30, 1921; reports of the director and heads of departments on the work of the station during the year, the experimental features of which have been for the most part abstracted elsewhere in this issue; and reprints of Bulletins 289-292, Special Bulletins 103-106, Technical Bulletins 49-51, and Circulars 44-47, all of which have been previously noted.

Report of the Dickinson Substation, 1920-1921, L. MOOMAW (*North Dakota Sta. Bul. 160* (1922), pp. 32, figs. 4).—This bulletin consists of the report of this substation for the years 1920 and 1921. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Williston Substation Report, 1914-1920, C. H. RUZICKA (*North Dakota Sta. Bul. 158* (1922), pp. 104, figs. 16).—The experimental work reported in this report of the superintendent of the substation is for the most part abstracted elsewhere in this issue.

Sixteenth annual report of the demonstration farms, 1921, E. I. OLSEN (*North Dakota Sta. Bul. 163* [1922], pp. 55).—Weather conditions during the growing season of 1921 and data as to cost of crop production, yields, and wheat milling and baking tests are briefly summarized. The experimental work reported is for the most part abstracted elsewhere in this issue.

Report of Porto Rico Station, 1921, D. W. MAY ET AL. (*Porto Rico Sta. Rpt. 1921*, pp. IV+27, pls. 4).—This contains the organization list, a summary by the agronomist in charge as to the general conditions and lines of work conducted at the station during the year, and reports of the chemist and assistant chemist, horticulturist, plant breeder, assistants in plant breeding and horticulture, entomologist, and specialist in farm management. The experimental work reported is for the most part abstracted elsewhere in this issue.

Reports of West Virginia Station, 1917-1918 and 1919-1920, J. L. COULTER (*West Virginia Sta. [Blen.] Rpts. 1917-18*, pp. 451-469, pls. 2; *1919-20*, pp. 499-524, pls. 13).—These reports contain, respectively, financial statements for the fiscal years ended June 30, 1917 and 1918, and 1919 and 1920, together with reports by the director on the work and publications of the station during the respective biennial periods.

The rise, development, and value of the agricultural experiment station, J. T. JARDINE (*Oregon Sta. Circ. 26* (1922), pp. 38, figs. 20).—An historical account of the development of experiment stations is followed by a description of the work under way at the Oregon Station and its substations and a discussion of the principal results it has obtained and some of its future needs.

Bimonthly Bulletin of the Western Washington Station (*Western Washington Sta. Bimo. Bul.*, 10 (1922), No. 4, pp. 65-88, figs. 4).—In addition to articles abstracted elsewhere in this issue, this number contains brief articles entitled Abortion and Associated Disturbances in Dairy Cattle, by W. T. Johnson; Fall and Spring Planting of Fruits, by J. L. Stahl; and Short Courses for Western Washington Farmers.

NOTES.

Delaware University and Station.—Following the death of Dean E. L. Smith, Dr. C. A. McCue, dean of the school of agriculture and director of the station and extension service, has been appointed dean of the men's college of the university and vice president from March 1 until July 1. During this time M. O. Pence, county agent leader, will act as director of the agricultural extension work.

G. T. Baker has been appointed assistant chemist, vice S. C. Noble, resigned.

Kansas College.—The west wing of Waters Hall is expected to be completed by June 1. This wing will be a limestone structure, three stories in height and costing about \$250,000. The first story and basement will be occupied by the dairy department, the second story by the poultry department, and the third by the department of agricultural economics.

Plans have been completed for a new seed house on the agronomy farm. This is to be a 2-story building 30 by 60 ft. with facilities for cleaning and storing seed, including a special roof structure to support heavy loads of seed corn.

Experiments relating to vitamins in animal nutrition are being conducted with dairy cattle, swine, chickens, and small experimental animals. These experiments involve nutrition as such and also the relations of vitamin deficiency to disease susceptibility. The work is carried on cooperatively by the departments of bacteriology, dairy husbandry, veterinary medicine, poultry husbandry, chemistry, and animal husbandry in four projects, and is supported in part by Adams funds and in part by State funds.

Kentucky Station.—Ralph Schneider, chemist in the public service laboratories, has resigned. James H. Martin has been appointed assistant chemist.

Missouri Poultry Station.—Authority has been granted by the State Poultry Board to conduct a State testing plant for the purpose of furnishing authentic production records for poultry breeders of Missouri. Seven hundred birds will be received for testing and trapnested, certificates of egg production being issued at the end of each year. The testing plant will be managed along the same lines as the National Egg-Laying Contest, although it will in nowise be in the nature of a contest.

Thirty new poultry houses have recently been constructed and for the present will be used in work by the students receiving vocational training.

The laboratory of the department of pathology and hygiene has been re-equipped, and a new hospital building to house birds under experimentation is being planned. Dr. Sivert Eriksen has assumed his duties as station pathologist, and Noel Hall, formerly with the State Marketing Bureau, has been appointed extension poultryman.

Rhode Island Station.—John B. Smith, formerly of the Texas Station, has been appointed associate in chemistry. Waldo L. Adams has succeeded Alfred J. Mortham, resigned, as assistant chemist.

Virginia Truck Station.—J. W. Trotter, assistant horticulturist, has resigned to become instructor in horticulture in the North Carolina College and has been succeeded by M. M. Parker, a 1922 graduate of Cornell University.

West Virginia Station.—A dairy barn is being erected at a cost of \$30,000.

Wisconsin University and Station.—A new section of the plant pathology greenhouses is nearing completion. The addition is 64 by 20 ft. in size, and is intended for use in connection with work on the relation of environment to plant development and plant diseases, especially in the control of soil temperature, soil moisture, and humidity. A series of experimental projects is already housed in the new structure, 17 staff members, State and Federal, and 21 graduate students using the new equipment. The cost of the new greenhouse and laboratory facilities is about \$17,000.

A tract of 95 acres of land leased for experimental work since 1916 at the Hancock Substation was acquired by purchase last November. Experiments in the farming of sandy soils will be continued on this area.

Dr. L. J. Cole, chairman of the department of genetics, has been granted leave of absence for one year, beginning July 1, to take charge of the animal husbandry division of the Bureau of Animal Industry, U. S. Department of Agriculture. John M. Fargo of the department of animal husbandry has been granted leave of absence for the remainder of the college year to take up graduate work at Harvard University.

West Indies and Caribbean Service of the U. S. Weather Bureau.—The organization of this important division of the National weather service has been completed and is now in full operation. It includes forecast, climatological, and aerial research branches, and issues daily forecasts and storm warnings and monthly and annual summaries of climatological data uniform with those of other divisions of the Weather Bureau. The service enlists the cooperation with the Weather Bureau of 25 distinct local Government agencies and includes 500 stations distributed as follows: Porto Rico, Virgin Islands, and Panama Canal Zone, including Panama, 100; British Colonies, 185; Cuba, 40; Haiti, 35; Santo Domingo, 55; Guadeloupe and Martinique, 35; Venezuela, 22; Dutch West Indies, 18; Yucatan, 8; Colombia, 2

The service is of agricultural importance to this country especially because of the large and rapidly increasing amount of American capital invested in agricultural enterprises in the West Indies, and in connection with the work of the agricultural experiment stations maintained by the Federal Government in Porto Rico and the Virgin Islands. A dominant factor in crop production in this area is the amount and distribution of rainfall. The service makes this valuable information for the first time available for general study and use. The occurrence and movements of tropical storms are recorded, and warnings are issued. Observations on evaporation, water temperature, and earthquakes are also reported.

Industrial Fellowship for Research on Edible Gelatin.—An industrial fellowship in the Mellon Institute of Industrial Research of the University of Pittsburgh has been established by the Edible Gelatin Manufacturers of America, Incorporated, for the purpose of ascertaining the food value of this product in its applications in the American dietary. In addition to experiments, a correlation of all available facts regarding edible gelatin will be made, to be held at the disposal of all users and prospective users of the product. The present incumbent of the fellowship is Dr. Thomas B. Downey.

Closing of Research Station of Olympia Agricultural Company, Limited.—Owing to the death of Lord Manton, the founder of this department, it has been found necessary to bring its work to a close. Dr. Charles Crowther, who has been in charge since its inception, has been appointed principal of the Harper Adams Agricultural College at Newport-Salop.

EXPERIMENT STATION RECORD.

VOL. 48.

MARCH, 1923.

No. 4.

To those who are interested in following the history and development of the Federal Department of Agriculture, the annual acts making appropriations for its support afford a valuable source of information. They prescribe the prospective lines of work of the Department in considerable detail, and limit quite rigidly the scope and direction of its activities. When properly interpreted they also serve as a useful basis of comparison for a period of years, although for various reasons it seldom happens that successive acts are directly comparable without more or less explanation.

The latest of these measures, signed by President Harding February 26, 1923, and making appropriations for the fiscal year ending June 30, 1924, is no exception in this respect, for it presents a number of important deviations from its predecessors. Thus, it carries a total of \$69,536,653, an apparent increase of \$32,762,480 over that of the previous year, or nearly 90 per cent, but as regards what may be termed the regular work of the Department practically all of this large increase is nominal. No less than \$32,300,000 is absorbed by two appropriations for road construction hitherto carried elsewhere. One of these provides \$29,300,000 for the cooperative construction of rural post roads and the other \$3,000,000 for the construction of forest roads and trails.

It is also important to state that the appropriation act for 1923 has been supplemented by subsequent allotments in three deficiency acts to an amount aggregating \$709,980, so that when these are taken into account the funds available for the Department next year will be actually somewhat smaller than those for the current year. Reductions have in fact been made in a number of items, largely upon the recommendation of the Bureau of the Budget, which it will be recalled now passes upon the estimates of the various executive departments. The congressional seed distribution is completely eliminated, and the allotment of \$360,000 formerly carried for this purpose is only partially offset by the inclusion of a new item of \$200,000 for the printing of the publications *Diseases of the Horse and Diseases of Cattle* for exclusive distribution by Members of Congress. Taken as a whole, the act provides for the maintenance of

most projects on the existing basis, but with some curtailments and some increases.

Another complication always met with in attempting to ascertain the Department's actual financial resources is found in the large funds provided in channels other than the appropriation act. Chief among these are the continuing appropriations, such as \$3,000,000 per annum for the Federal meat inspection, \$4,580,000 for the extension work under the Smith-Lever Act, and a number of funds for the construction of roads and trails and other purposes by the Forest Service. These appropriations aggregate for the fiscal year 1924 \$12,220,000. There will also be available for either 1923 or 1924 funds aggregating \$140,000 carried in the final deficiency bill, including \$40,000 for developing the use of airplanes as a means of distributing insecticides for the control of the boll weevil and other cotton insects, and \$100,000 for the exploration of rubber-producing regions and studies with rubber-producing plants. Still other funds are provided in a joint resolution enacted March 3, 1923, applying to all departments of the Government, and continuing the so-called "\$240 bonus" paid to most employees whose salaries do not exceed \$2,500 per annum, the allotment for the Department of Agriculture for this purpose being \$3,341,800 for the ensuing year.

No increases in salaries as regards chiefs of bureaus and other statutory employees are provided in the appropriation act, and a separate measure establishing a number of these salaries at a materially higher level, which passed the House of Representatives and was awaiting consideration by the Senate following a favorable report by its Committee on Agriculture and Forestry, failed of enactment. The act, however, does continue and enlarge the provisions of the previous year raising the maximum limit of \$4,500 for members of the scientific staff paid from the Department's general appropriations. This action will permit the payment of salaries from lump funds during the coming fiscal year as high as \$6,500, the number of individuals eligible to receive over \$5,500 being increased from 3 to 5, and of those who may receive salaries above \$5,000 but not exceeding \$5,500 from 8 to 12.

The entire situation as regards Federal salaries was also materially altered by the passage in the closing hours of the Congress of what is known as the Classification Act of 1923. This act prescribes a system of classification for most of the civilian personnel of the Government, establishing salary schedules for a professional and scientific, a subprofessional, a clerical, administrative, and fiscal, a custodial, and a clerical-mechanical service. Of these, the professional and technical service is made up of seven grades, with a salary range from \$1,860 to \$7,500, or even higher if specifically authorized by law. A tentative allocation has already been completed for employees in

Washington, and a survey of the field services is to be undertaken. In no case, however, will the final allocation become effective until July 1, 1924.

The chief innovation carried by the new appropriation act is a reorganization of some of the Department's activities relating to extension, experiment stations, publications, and home economics. Under this reorganization the States Relations Service, established in 1915 to represent the Department in its relations with the States, and the Division of Publications, one of the oldest branches of the Department, will be discontinued on July 1, 1923. In their stead are set up as separate units Offices of Editorial and Distribution Work, an Office of Experiment Stations, and an Extension Service, while the work hitherto carried on by the Office of Home Economics of the States Relations Service is given the status of a separate bureau.

The Office of Experiment Stations, originally organized in 1888 to represent the Department in its relations with the State experiment stations, will continue to carry on the functions which it has been discharging within the States Relations Service. Chief among these functions are the administration of the Hatch and Adams Acts, the preparation of *Experiment Station Record* and other publications relating to the work of the stations, and the conduct of experimental work in Alaska, Hawaii, Guam, and the Virgin Islands. The office will retain substantially its present staff and organization, but will function under the supervision of the Director of Scientific Work.

The Extension Service will combine with the present duties of the Office of Extension Work of the States Relations Service the work relating to agricultural exhibits and motion pictures formerly carried on in the Division of Publications. In this connection a new supervisory position, that of Director of Extension, is provided coordinate with the Directors of Scientific and of Regulatory Work.

The establishment of the Bureau of Home Economics is a recognition of the increasing attention being given by the Department to the home maker. Originally instituted in 1894 under the direction of the first chief of the Office of Experiment Stations, Dr. W. O. Atwater, the nutrition investigations then undertaken have been gradually broadened to deal with household equipment, textiles, and other domestic problems, with a view to furnishing information both directly to home makers and through the extension workers and other agencies. Since the initial appropriation for the bureau remains at \$71,760, the amount available for the present year, no immediate large scale expansion of this work is anticipated, although it is expected that efforts will be made to coordinate more com-

pletely the numerous projects of interest to home makers in progress in various parts of the Department.

Taking up the allotments of the various bureaus and offices in detail, the Office of the Secretary receives a total of \$6,519,236. Included under this head by the plan of reorganization just referred to are the usual payments to the States of \$1,440,000 under the Hatch and Adams Acts, \$1,300,000 for the supplementary extension funds in connection with the Smith-Lever Act, \$1,284,350 for the Department's own cooperative demonstration work, and \$760,000 for the Department's printing and binding. This last item does not include the special item of \$200,000 for the publication of the Diseases of the Horse and Diseases of Cattle, but represents a net reduction of about \$80,000 from the funds available for the Department's printing during the current year.

The Office of Experiment Stations receives as its initial allotment \$34,300 for statutory salaries and \$64,300 as its lump fund for general expenses. A reduction from \$75,000 to \$70,000 is made for the Alaska Stations, with no changes in the present grants of \$50,000 each for Hawaii and Porto Rico, \$15,000 for Guam, and \$20,000 for the Virgin Islands.

The funds for participation by the Department through exhibits at expositions and fairs, administered under the new plan by the Extension Service, are increased from \$70,000 to \$95,080, \$25,000 being made immediately available for an exhibit at the National Dairy Exposition. A special fund of \$30,000 is also granted for recording, printing, and distributing the proceedings of the World's Dairy Congress, which is to be held in Washington, D. C., October 2-5, 1923.

The remaining allotments for the Office of the Secretary include \$472,520 for statutory salaries and other compensation. Reductions of \$5,000 each have been made in the Department's funds for miscellaneous expenses and rent in the District of Columbia, leaving \$156,000 and \$176,866, respectively, available for these purposes. The Offices of Editorial and Distribution Work, which are to be headed by an assistant in charge at a salary of \$5,000 per annum, receive a total of \$311,520. The Extension Service is granted, in addition to the appropriations already mentioned, \$189,300 for statutory salaries and general expenses.

The various projects of the Weather Bureau are continued, and its total is increased from \$1,925,235 to \$1,939,255. A part of this increase is absorbed by central office expenses and station salaries, but \$6,020 additional is granted to extend its aerological observations.

The appropriations for the Bureau of Animal Industry carried in the act are reduced from \$6,968,076 to \$6,845,606, but still exceed

those of any other bureau. The items for hog cholera eradication and meat inspection are decreased by \$103,980 and \$25,000, respectively, some curtailment of the hog cholera campaign in the outlying sections being thereby necessitated. Funds aggregating \$32,680 are provided for a \$20,000 dairy barn and improvements at the abattoir and animal husbandry laboratory at Beltsville, Md., and to extend the nutrition studies with meat animals in progress there. No change is made in the remaining allotments of the bureau or in the special miscellaneous funds of \$46,500 for live stock experiments and demonstrations in the sugar cane districts, \$40,000 for experiments in dairying and live stock production in semiarid and irrigated districts, and \$6,500 for the maintenance of the field station at Woodward, Okla. The emergency fund for use in combating outbreaks of foot-and-mouth disease and other contagious diseases of animals is reduced from \$50,000 to \$5,000.

Mainly because of the elimination of the congressional seed distribution, the total appropriations of the Bureau of Plant Industry show a reduction from \$3,527,910 to \$3,376,470. Most of its projects are left unchanged, but there are numerous increases both for physiological studies and for combating specific diseases. One of the largest of these supplies \$75,000 additional for the barberry eradication campaign to combat stem rust of wheat, making \$425,000 available for this purpose. Other increases include \$4,000 for citrus fruit diseases, \$2,500 for root rot of cotton, \$7,500 for potato diseases, and \$10,000 for further studies of plant-infesting nematodes. On the other hand, a net decrease of \$70,000 is made in the funds available for the citrus canker campaign because of the marked progress attained toward its elimination.

An increase of \$10,000 is granted to enlarge the date production studies in the Southwest, and another of \$20,000 to increase the cotton variety improvement work, with special reference to the southeastern States, where much depression has resulted from the appearance of the boll weevil and other unfavorable conditions. There is also a net increase of \$25,000 for cereal investigations, making \$272,505 for this purpose, one of \$10,000 for studies of sugar plants, for which \$104,115 is provided, one of \$3,600 for studies of weed control, \$3,000 additional for studies of pecans, and \$5,000 additional for clover studies.

The allotment for studies of dry land agriculture is increased by \$11,000 to provide for the repair and replacement of buildings and equipment at the bureau field stations, and that for pomological studies by \$10,000 for buildings and equipment at the experimental vineyards purchased by the Department last year in California. Because of the virtual completion of the \$50,000 heating plant at

the Arlington Experimental Farm, the item for the maintenance of this farm is decreased accordingly.

The aggregate of the appropriations for the Forest Service shows a decrease from \$6,953,782 in the regular and deficiency appropriations to \$6,633,582. This is in addition to the usual miscellaneous funds of \$450,000 for the acquisition of additional lands at the headwaters of the navigable streams, \$400,000 for cooperative fire protection of forested watersheds in these areas, and \$60,000 for other purposes. If these items are included the total is \$7,543,582, but as usual this expenditure will be offset to a considerable degree by receipts from the national forests, those for the fiscal year 1922 amounting to \$6,506,650.56.

There is some readjustment of funds for the Service, including the provision of a lump fund of \$200,080 in lieu of certain statutory salaries for the short time employment of forest rangers and guards at a rate of \$1,220 per annum or less, this change being expected to bring greater flexibility under seasonal conditions. New language is inserted in the section dealing with fighting forest fires, the use of \$25,000 of the allotment for meeting emergencies caused by insects being authorized.

A grim reminder of the fire menace is given in two small appropriations for marking and caring for the graves of fire fighters who have lost their lives in protecting the national forests. About 70 of these graves have now been located at Wallace and St. Maries, Idaho.

The allotment for the construction of sanitary facilities and fire preventive measures on public camp grounds is enlarged from \$10,000 to \$15,000. An increase of \$23,000 in the funds for roads and other improvements is to be utilized in the building of fences, development of water supplies, and eradication of poisonous plants on the range areas of the national forests.

The research activities of the Service receive special stimulus in two increases, one of these enlarging the funds for silvicultural and dendrological investigations from \$85,000 to \$135,000. This provision will make possible the establishment of two additional forest experiment stations. At present six of these stations are being maintained in the South and West, with staffs of about six technical men in each case. It is expected that the new stations will be located in the cut-over areas of the Great Lakes region and in New England.

There is also a net increase of \$15,000 for the studies of means of utilization of forest products. It is expected to use about half of this sum in lumber grading studies, and the remainder in an investi-

gation of wastes in the manufacture of paper and of methods of finishing woods with paints and varnishes.

The Bureau of Chemistry receives an increase from \$1,277,631 to \$1,320,031. The wool scouring waste investigations in progress for several years are now reaching completion, resulting in the elimination of \$9,000 for this purpose. The principal items of increase are \$33,000 additional to meet the steadily rising costs of enforcement of the Food and Drugs Act, \$15,000 to extend the studies of table sirups, and \$17,500 to develop the work of the laboratories dealing with crop chemistry, protein, and oils.

The funds of the Bureau of Entomology show an apparent increase from \$1,778,080 to \$1,797,880, but the comparison is somewhat complicated by the various deficiency appropriations to which reference has already been made. Provision is also carried elsewhere in the act of \$411,400 for the pink bollworm campaign directed by the Federal Horticultural Board, \$363,010 for other expenses of that board, and \$13,000 for the eradication of the *Parlatoria* date scale.

Funds for combating the spread of the European corn borer, reduced last year by \$75,000, are partially restored by an increase from \$200,000 to \$225,000, \$100,000 of which is made available only when an equal amount has been contributed by the States or other interested sources. This insect is now causing considerable commercial injury to sweet corn and other garden crops in New England, and has spread into Maine and Rhode Island and to some extent along the southern border of Lake Erie.

An increase of \$20,000 is granted to extend the nursery inspection work against the Japanese beetle, which is spreading rapidly and increasing in destructiveness. There is also \$5,000 additional to investigate pecan insects, notably the green soldier bug and the pecan-nut case bearer, both of which have become serious menaces in Georgia and Florida, a like increase for the campaign against the Mexican bean beetle, \$4,000 to study aphid injury to cannery peas, \$3,000 each to investigate an Irish potato and tomato weevil recently introduced from abroad into Mississippi, a number of insects affecting textile fabrics, and the effect of low temperature upon insects attacking articles in cold storage. On the other hand there is an apparent reduction of \$69,000 in the amount available for the gipsy and brown-tail moth campaign, the new allotment being \$531,000.

By far the largest increase accorded any bureau is that given the Bureau of Agricultural Economics, its total rising from \$3,556,183 to \$4,005,853. The market news service on fruits and vegetables is granted an increase from \$405,000 to \$700,000, thereby permitting of the resumption of some of the leased-wire services discontinued at the close of the war, when the appropriations for this purpose reached a maximum of \$1,368,580. There is also an increase of

\$100,000 in the allotment for market inspection of perishable foods and other farm products, which will permit of the beginning of the inspection of hay and the extension of the work with fruits and vegetables and poultry products. The studies of the marketing and distribution of farm products are also to be enlarged, the appropriation of \$500,000 for this purpose representing a net increase of \$39,580. For crop and live stock estimates \$397,000 is granted, a net increase of \$25,000.

The funds for the enforcement of the various regulatory acts administered by the bureau are continued much as at present except for increases of \$5,000 and \$1,200, respectively, for the U. S. Grain Standards Act and the Standard Container Act, and one of \$16,400 for additional employees under the U. S. Warehouse Act. A steady growth of interest in the operations of the Warehouse Act is reported, there being licensed under its provisions on November 20, 1922, 400 warehouses for cotton, 218 for grain, 23 for wool, and 52 for tobacco.

The work of the remaining branches is continued without material change. An increase of \$1,700 is given the Bureau of Biological Survey, making its total \$872,265. In addition to the large appropriations for road construction already mentioned, the Bureau of Public Roads receives \$473,480, a decrease of \$9,840 in its minor statutory salaries. The Bureau of Soils is given \$358,975, a reduction from \$371,775, mainly in the allotment for fertilizer studies. The Library, whose collections now comprise approximately 165,000 volumes and which receives currently some 3,000 periodicals, is granted \$62,660, an increase of \$5,000 to meet the increasing cost of books, periodicals, and supplies. The Division of Accounts and Disbursements is allotted \$3,600 additional for salaries, making its total \$59,420. For the enforcement of the Insecticide and Fungicide Act \$155,670 is granted, for the operation of Center Market in Washington, D. C., \$176,000, and for the collection of farmers' seed grain loans \$20,000.

The new act considered as a whole is thus quite largely a routine measure, comparatively free from general legislation and with most of its allotments corresponding closely to the Budget estimates and the present appropriations. Opportunity for extension and development is accorded some phases of the work, however, especially along economic lines, certain administrative and research projects, and the control of specific pests and diseases. The outstanding innovations in the act are doubtless the establishment of the new Bureau of Home Economics and the plan of regrouping provided for the Department's activities with relation to the States in research and extension.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Chemical changes in calcium arsenate during storage, C. C. McDONNELL, C. M. SMITH, and B. R. COAD (*U. S. Dept. Agr. Bul. 1115 (1922)*, pp. 28, figs. 52).—As criteria for the chemical changes during storage occurring in the insecticide powdered calcium arsenate, changes in the carbon dioxide and water-soluble arsenic oxide were selected. Determinations of these constituents at varying periods during storage in the different containers were conducted on material obtained from six manufacturers of this insecticide. The containers included tight metal drums, unlined and paper-lined sugar barrels, heavy hardwood barrels, and unlined and paper-lined veneer drums. Soluble arsenic oxide was determined by the Official method and carbon dioxide in an apparatus similar to the one described by Chapin (*E. S. R.*, 39, p. 503). The results obtained at varying intervals over a period of about 2 years are reported in tables and graphs.

These results show that both arsenic oxide in water-soluble form and carbon dioxide increased in all of the samples except those in the tightest containers. In general the carbon dioxide begins to increase almost immediately, but the water-soluble arsenic does not begin to increase for some time, after which the increase runs roughly parallel to that of the carbon dioxide, both tending to reach a limiting value at about the same time. The rate of change in the samples tested varied to a marked extent with the type of container. In the metal drums there was practically no change. In the hardwood barrels the average increase in water-soluble arsenic after 12 months was 0.06 per cent and after 20 months 0.15 per cent. Corresponding figures for carbon dioxide were 0.85 and 1.4 per cent, respectively. Paper lining of veneer drums and sugar barrels did not protect the material from decomposition. In the veneer drums the average increase in soluble arsenic oxide was 0.15 per cent at the end of 12 months and 0.3 per cent after 20 months and in carbon dioxide 1.38 and 2.21 per cent, respectively. In the sugar barrels the corresponding figures were 0.31 and 0.45 per cent for soluble arsenic oxide and 1.72 and 2.01 per cent for carbon dioxide.

From the point of view of possible injury to foliage, it is concluded that none of the samples stored in metal drums or tight hardwood barrels suffered sufficient change in 20 months to be injuriously affected for use, but that in a few cases of storage in veneer drums and sugar barrels the amount of soluble arsenic oxide at the end of the 20-month period was sufficient to make doubtful its safety for application on certain foliage. Under conditions involving long storage the use of tight sheet-metal drums is recommended.

A physical and chemical study of milo and feterita kernels, G. L. BIDWELL, L. E. BOPST, and J. D. BOWLING (*U. S. Dept. Agr. Bul. 1129 (1922)*, pp. 8, fig. 1).—This study of the composition of the kernels of two of the grain sorghums, milo and feterita, supplements a similar study of the kafir kernel (*E. S. R.*, 39, p. 164). For purposes of comparison data are also included on

kafir and on corn. The physical properties reported include measurements of the average thickness, width, and length of 50 kernels of dwarf milo and dwarf feterita and the proportion of bran, germ, and endosperm in corn, kafir, milo, and feterita kernels.

The data on the chemical composition include a comparison of the composition of the whole kernels of kafir, milo, and feterita on a water-free basis and comparisons of the different parts of the corn and kafir kernel with the corresponding parts of the milo and feterita. With the exception of protein, which was considerably higher in feterita than in kafir or milo, and starch, which was highest in milo, next in feterita, and lowest in kafir, the kernels of these three sorghums varied little in composition. The chief differences in the composition of the component parts of the four grains were a lower content of ash and ether extract in corn hulls than in those of the other three, a comparatively high content of fat in the horny endosperm of the corn and a high content of protein in that of feterita, and a low ether extract content in the milo germ.

A comparison was also made of the diastatic power of malts made from kafir, milo, and feterita with that of barley. The malts were prepared as described in Farmers' Bulletin 410 (E. S. R., 24, p. 14) and their diastatic power determined as the Lintner value according to Sherman et al. (E. S. R., 24, p. 122). Determinations were also made of the moisture content of the various malts and of the acidity calculated as lactic acid of barley and kafir malt. The diastatic values of the four samples calculated on the dry basis were barley 174.1, kafir 10.2, feterita 36.9, and milo 37.5°. It is pointed out that under the conditions of the experiment the diastatic power of the barley was much higher than would be obtained under ordinary brewing conditions in which the diastatic power is sacrificed to a considerable extent to bring out the color and flavor of the malt, and that if grain sorghums were subjected to temperatures that would give the color and flavor required in a dry malt their diastatic power would be too low for practical brewing purposes.

It is concluded that, while not suitable for malting purposes, the kernels of the three sorghums studied offer possibilities as food for man and animals and as raw products for the manufacture of starch, sirup, alcohol, and oil.

Hawaiian starches, J. C. RIPPERTON (*Hawaii Sta. Rpt. 1921, pp. 38-40, pl. 1*).—Samples of starches extracted at the Haiku Substation by commercial methods from some Hawaiian root crops gave the following percentages of starch: Edible canna 81.2, sweet potato 84.3, and cassava 83.6 per cent. Analyses of the residues from the extraction showed, however, a very low percentage extraction, indicating that improvement in methods would be necessary before commercial extraction could be done with profit. As a possible commercial source of starch the tree fern is suggested. The core of the average sized fern is said to weigh from 50 to 70 lbs. and to be nearly pure starch. Two samples of starch prepared from the tree fern by the usual methods gave starch percentages of 82.01 and 83.43 as compared with 87.1 for corn starch and 82.8 for arrowroot starch.

Corn oil, its preparation and uses, A. F. SIEVERS (*Amer. Food Jour., 17 (1922), No. 11, pp. 27, 28*).—This is a general description of the manufacture and refining of corn oil, its physical and chemical properties, and the statistics of its production.

Beef bone fat and neat's-foot oil, H. ECKART (*Ztschr. Untersuch. Nahr. u. Genussmit., 44 (1922), No. 1, pp. 1-29, figs. 2*).—An extensive study is reported of the composition and physical constants of the fat obtained from different parts of the body of beef cattle, particularly of the bone fat and the oil obtained from the hoofs, or neat's-foot oil. Methods of preparing each of these are described, and tables are given of the analytical data obtained. The aver-

age composition of the neat's-foot oil and bone fat, respectively, is as follows: Stearic acid from 2 to 3 per cent and from 19 to 21 per cent, palmitic acid 17 to 18 and 20 to 21, oleic acid 74.5 to 76.5 and 53 to 59, glycerin 5 to 10 and 5 to 10, and unsaponifiable fraction 0.1 to 0.5 and about 0.5 per cent.

Wheat gluten, J. GERUM and C. METZER (*Ztschr. Untersuch. Nahr. u. Genussmtl.*, 44 (1922), No. 2, pp. 86-89).—Determinations of the percentage of phosphoric acid in wheat flour of various percentage extractions and of its distribution in the gluten and wash water from the gluten of these flours are reported, the results of which indicate that, contrary to the conclusion of Levy (E. S. R., 23, p. 113), the phosphoric acid is found in the largest amount in the wash water instead of in the gluten.

Determinations of the P_2O_5 content of the gluten of wheat flour to which varying amounts of rye flour have been added are also reported. These show that with increasing amounts of rye the ratio of P_2O_5 to the nitrogen of gluten becomes smaller and smaller. Similar experiments, in which in place of rye flour indifferent neutral water-insoluble materials have been added to the wheat flour, are said to have given similar results, indicating that the amount of gluten and of the P_2O_5 which it contains is dependent upon the physical properties of the admixed substances.

On glutathione.—II. A thermostable oxidation-reduction system, F. G. HOPKINS and M. DIXON (*Jour. Biol. Chem.*, 54 (1922), No. 3, pp. 527-563, fig. 1).—A further study of the properties of glutathione, the autoxidizable substance present in animal tissues (E. S. R., 46, p. 110), is reported. It is shown that when tissue is washed until it has lost its power of reducing methylene blue and is then suspended in a buffer solution, the addition of glutathione in its oxidized disulphid form promptly restores its reducing power. The reducing system in tissue is shown to be thermostable, since heating in the absence of air at 100° C. or thoroughly extracting with boiling water does not destroy its reducing power in the presence of glutathione. It is, however, sensitive to oxygen either in the atmospheric form or in hydrogen peroxid. In the changes taking place when glutathione is brought into contact with this thermostable reducing substance, the glutathione itself undergoes no change other than the reversible changes confined to the sulphur group, and hence acts as a carrier or catalyst but not of an enzym nature.

"The facts suggest that coexisting in living tissues with the specialized enzymic mechanisms is a thermostable mechanism for oxidations and reductions. Materials in some close association with structural elements are oxidized, anaerobically, with the coagency of the sulphur group in glutathione."

Collodion sacs for aerobic and anaerobic bacterial cultivation, F. L. GATES (*Jour. Expt. Med.*, 35 (1922), No. 5, pp. 635-646, pls. 2, fig. 1).—Detailed descriptions, with accompanying figures and photographs, are given of the preparation of collodion sacs to be used in V-tubes and in flasks for aerobic and anaerobic bacterial cultivation. The sacs were originally devised to hold fresh animal tissue which has been found to be necessary for the growth of certain organisms, but which, through the production of protein precipitates on autolysis, interferes with the subsequent examination of the medium or the use of the medium for serological studies.

The vaseline tube and syringe method of micro-gas analysis of bacterial cultures, J. H. BROWN (*Jour. Expt. Med.*, 35 (1922), No. 5, pp. 667-684, pls. 3, fig. 1).—Methods are described for the measurement of the gas formed in anaerobic culture under vaseline and for the removal of samples of the gas for analysis. A comparison is reported of the results obtained by the use of the method described, the Smith fermentation tube, and the tube of Eldredge and Rogers, and the advantages are summarized of the present technique.

The optimum concentration in hydrogen ions for the development of certain microorganisms, K. G. DERNBY (*Ann. Inst. Pasteur*, 35 (1921), No. 4, pp. 277-290, figs. 4).—The limiting and optimum pH values for the growth of about 40 different microorganisms in a sugar-free medium are reported in tables and diagrams.

The data indicate that the bacteria studied can be divided into two groups, first, those capable of supporting great variations in H-ion concentration, for example *Bacillus subtilis* and *B. proteus* and certain anaerobes, and second, those growing only within strict limits. In the second group are found the more important pathogenic microorganisms. For the first group it is considered of little importance to determine the pH value of the medium, but this determination is thought to be absolutely necessary for organisms of the second group.

Lunge-Berl chemical-technical methods of analysis, edited by E. BERL (*Lunge - Berl Chemisch - technische Untersuchungsmethoden*. Berlin: Julius Springer, 1921, 7. ed., rev. and enl., vol. 1, pp. XXXII+1099, pl. 1, figs. 291; Sup. pp. 96).—The seventh edition of this volume (E. S. R., 22, p. 508) has been edited by E. Berl with the assistance of a large number of collaborators. In addition to a revision of the material of the previous edition a number of new sections have been added.

A new combined fractionation method for proteins and their derivatives, M. A. RAKUSIN (*Biochem. Ztschr.*, 130 (1922), No. 4-6, pp. 432-441).—By extraction of dry peptone with 95 per cent alcohol and successive 24-hour periods of adsorption of the extract with aluminum hydroxid, the author states that he has been able to effect a quantitative separation of the peptone, as determined by color tests, as follows:

On extraction with alcohol, the material is separated into an insoluble substance giving only the xanthoproteic and the Liebermann reactions, and a solution giving the biuret, Millon, Adamkewitsch, Mollisch, Pettenkofer, and Ostromyslenski reactions. The residue, after standing for 24 hours with 10 per cent aluminum hydroxid solution in water, separates into a precipitate consisting of tryptophan and a filtrate giving no protein reaction. The original alcohol extract on treatment with a 10 per cent alcoholic solution of aluminum hydroxid for 24 hours gives a precipitate containing all of the tyrosin of the original extract. A second treatment of the extract with aluminum hydroxid is said to precipitate the constituents giving the biuret reaction, a third treatment the amino acids with free NH_3 groups, and a fourth treatment tryptophan, leaving in the final filtrate only carbohydrates and traces of tryptophan.

The mechanism of the influence of acids and alkalis on the digestion of proteins by pepsin or trypsin, J. N. NORTHROP (*Jour. Gen. Physiol.*, 5 (1922), No. 2, pp. 263-274, figs. 5).—Data are presented showing that the rate of digestion of proteins "may be predicted from the amount of ionized protein as determined by the titration curve or conductivity. The rate of digestion is a minimum at the isoelectric point of the protein and a maximum at the pH at which the protein is completely combined with acid or alkali to form a salt. The physical properties of the protein solution have little or no effect on the rate of digestion."

The tryptophan content of some proteins, C. E. MAY and E. R. ROSE (*Jour. Biol. Chem.*, 54 (1922), No. 2, pp. 213-216).—Determinations of the tryptophan content of about 12 different proteins are reported, the following method being used: Each protein in 0.05 and 0.1 gm. portions was accurately weighed and added to a solution of 100 cc. of 1:1 c. p. HCl containing 1 cc. of Ehrlich's *p*-dimethylaminobenzaldehyde reagent. The mixture was digested at 35° C. for 24 hours and allowed to stand for 48 hours at room temperature.

The solution was then matched in a colorimeter with a standard prepared from 0.1 gm. of casein similarly treated. The values obtained are as follows: Casein 1.5 per cent, lactalbumin 2.4, gliadin 1.05, glutenin 1.80, edestin 1.5, glycinin 1.65, ovovitellin 1.74, egg albumin 1.11, phaseolin 0.80, maize gluten 1.08, legumin (vetch) 1.05 per cent, and zein and gelatin negative.

The nitrogen distribution in Bence-Jones' protein, with a note upon a new colorimetric method for tryptophan estimation in protein, E. LÜSCHE (*Biochem. Jour.*, 16 (1922), No. 5, pp. 556-563).—In the course of a study of the nitrogen distribution in Bence-Jones' protein, the details of which are reported in this paper, a slight modification of the colorimetric procedure of Flürth and Lieben (*E. S. R.*, 45, p. 312) was adopted. This consisted in the use of benzaldehyde instead of formaldehyde, the change being recommended on the ground that the maximum color is about twice as deep as with formaldehyde and that no precipitate is produced even after several days.

A method for the purification of picric acid for creatinin determinations, S. R. BENEDICT (*Jour. Biol. Chem.*, 54 (1922), No. 2, pp. 239-241).—As the result of the systematic investigation of different procedures for purifying commercial picric acid to make it suitable for creatinin determinations, the author recommends as most satisfactory the crystallization of the picric acid from benzene. The technique for this purification, starting with a technical grade of commercial picric acid, is described in detail.

A new accelerator of the destruction of organic matter in the determination of nitrogen by the Kjeldahl method, M. and I. SPOBOWSKY (*Ann. Chim. Analyt.*, 2 ser., 4 (1922), No. 9, pp. 266, 267).—Mercurous iodid has been found to be a satisfactory agent for hastening the oxidation of organic matter in the Kjeldahl nitrogen method. It is said to react much more rapidly than metallic mercury.

Studies in the titration of acids and bases, J. L. LIZIUS and N. EVERS (*Analyst*, 47 (1922), No. 557, pp. 331-341, fig. 1).—The authors discuss the theory of the application of H-ion concentration determinations to the titration of acids and bases and the selection of the proper indicators for such titrations, and present in tabular form the results of such titrations with respect to pH at the end point (for convenience called pT), the most suitable indicator for the titration, and the end color of the reaction. This table is supplemented by notes concerning special points in some of the titrations.

The isolation of histidin from blood, S. DEMJANOWSKI (*Hoope-Seyler's Ztschr. Physiol. Chem.*, 122 (1922), No. 1-3, pp. 93-97).—A method of preparing histidin from ox blood is described as follows:

A volume of 12.5 liters of a mixture of 2 parts blood and 1 part of hydrochloric acid, specific gravity 1.19, is heated for six hours in an autoclave at 1.5 atmospheres pressure, after which the solution is treated with enough powdered sodium carbonate to make the reaction only slightly acid toward litmus. After standing for 24 hours the mixture is filtered, and the filtrate is made decidedly alkaline with saturated sodium carbonate and heated until ammonia is no longer evolved. It is then cooled, filtered, and the filtrate diluted with water and treated with hot saturated mercuric chlorid to complete precipitation. The precipitate is filtered, washed carefully with water, dissolved in a very small amount of hydrochloric acid, and finally treated with saturated sodium carbonate and mercuric chlorid. After standing for a short time the precipitate is filtered, washed carefully, suspended in water, and decomposed with hydrogen sulphid. The filtrate is then heated over a free flame and finally on a water bath until it is reduced to the consistency of a thick sirup. On the addition of a small amount of hydrochloric acid

the histidin crystallizes in the form of the dichlorid. It is stated that in this way 90 gm. of crude histidin dichlorid can be obtained from 8½ liters of blood.

Determination of sucrose in the presence of other sugars by means of the hydroxids of the alkaline earth metals, A. BEHRE and A. DÜBING (*Ztschr. Untersuch. Nahr. u. Genussmit.*, 44 (1922), No. 2, pp. 65-70).—The method is similar to that of Jolles (*E. S. R.*, 24, p. 704), in which the sugar is heated with N/10 alkali, which destroys the optical activity of the reducing sugars but not that of sucrose. In the present study the hydroxids of the alkaline earth metals calcium and barium were used in place of those of the alkali metals, the only essential difference being the somewhat longer period required for the reaction. Data are given and discussed on the sucrose determination in mixtures of sugar with lactose, in milk powder, and in milk cocoa.

The bacteriology and mycology of cane sugar deterioration, N. and L. KOPELOFF (*Abs. Bact.*, 6 (1922), No. 5, pp. 221-225).—This is a bibliographic review with 54 references to the literature.

English-French-German dictionary of chemical and physical terms, R. CORNUBERT (*Dictionnaire Anglais-Français-Allemand de Mots et Locutions Intéressant la Physique et la Chimie. Paris: Dunod, 1922, pp. XXXI+297*).—In this English-French-German dictionary of chemical and physical terms the vocabulary is arranged in three parallel columns with a single alphabetical order for the three columns, the words in alphabetical sequence being set in heavy type and the synonyms in the other two languages, when of entirely different spelling and origin, in lighter type. As the volume is prepared particularly for the use of French readers, preliminary sections in French are devoted to a brief tabulation of the German vocabulary for inorganic and organic chemistry and mineralogy, remarks on the German vocabulary for chemical terms where differing from English and French, lists of the principal German abbreviations, prefixes, and irregular verbs, similar lists of English abbreviations and irregular verbs, and the equivalent English and metric units of length, surface, and volume.

METEOROLOGY.

The new service of agricultural ecology in Italy (*Nuovi Ann. [Italy] Min. Agr.*, 1 (1921), No. 2, pp. 395-398; *trans. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr.*, 13 (1922), No. 3, pp. 293-297).—The establishment, under the Ministry of Agriculture, of a new service of agricultural (ecological) meteorology, as provided for in a law enacted April 7, 1921, is announced. The duties of this service "consist in the systematic study of the physical environment in which agriculture is practiced with a view to determining by a well-defined method the principles governing the adaptation of crops to the climate of the different physiographical regions. These studies will at first be confined to such meteorological phenomena as have the most easily measurable effects, but later, with the cooperation of the geological bureau, the investigations will be extended to the agrogeological and topographical factors, in order to obtain a complete knowledge of the physical conditions under which farm crops grow."

The new service consists of a central bureau of agricultural ecology and several ecological stations. These stations are of three classes: "(1) First-class stations where parallel observations are made on the course of meteorological phenomena in the air and at various depths in the soil, and on the development of the plants and varieties according to the instructions received from the central bureau; (2) second-class stations where meteorological observations in the air and observations of plant growth are made; (3) sup-

plementary stations. Here independent studies are carried out without the aid of special instruments on the growth of plants and crop yield in connection with weather conditions."

The data are to be used in determining accurately the connection between a plant and its environment. "Thus in the case of wheat, definite information is obtained on the following points: (1) Which among all the varieties cultivated in or suitable for introduction into a region is the most suitable for any given locality; (2) the best dates for sowing, so that the times when the plant is most susceptible may coincide with the most favorable periods; (3) the best cultural operations and the most suitable time for carrying them out, in order to counteract the negative action of unfavorable meteorological conditions; (4) these data are also used to direct the breeder who is anxious to unite in the same individual, and in definite proportions so as to obtain the maximum yield, the two characters, specific productivity and resistance to the most dangerous and injurious meteorological conditions."

The climatology of wheat in Italy, G. AZZI (*Nuovi Ann. [Italy] Min. Agr.*, 2 (1922), No. 3, pp. 453-624, figs. 11).—This is a detailed summary, with attempted correlations, of meteorological data and wheat yields in different parts of Italy, based on the results of studies carried on through the network of agricultural stations of applied geography and meteorology, organized by the author in 1918 as previously noted (*E. S. R.*, 46, p. 15). It describes the general climatic conditions and the geographic distribution of varieties of wheat in the different wheat growing regions of Italy; presents and interprets phenological data pertaining to wheat growing in the form of so-called phenoscopic charts; defines and classifies adverse meteorological phenomena in terms of their frequency and intensity and their effect on growth and yield of wheat in the various physiographic zones in Italy; classifies varieties of wheat with reference to their power to withstand adverse meteorological conditions; and uses the data regarding wheat to establish certain fundamental characteristics of the general ecological problem of Italy with reference to agriculture.

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data*, 9 (1922), Nos. 9, pp. [189], pls. 4, fig. 1; 10, pp. [188], pls. 4, fig. 1).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for September and October, 1922.

Weather conditions, C. G. SELVIG (*Minnesota Sta., Crookston Substa. Rpt.* 1921, pp. 9-11).—Observations at the Northwest Experiment Station, Crookston, Minn., on temperature, precipitation, cloudiness, and winds, 1919-1921, and killing frosts, 1897-1921, are tabulated and briefly discussed. The mean temperature of 1921 was 40.6° F., as compared with a 10-year average of 38.7°. The total precipitation was 15.93 in., as compared with a 10-year average of 17.7 in. The frost-free period of 1921 extended from May 18 to October 3, as compared with the 25-year average of May 19 to September 23. "Had it not been for the abnormally high temperature during the latter part of June and early July, the season would have been an ideal one."

Climatic conditions, P. E. MILLER (*Minnesota Sta., Morris Substa. Rpt.* 1921, pp. 6-9).—Observations at the West Central Experiment Station, Morris, Minn., on temperature, precipitation, and cloudiness, 1916-1921, as compared with the 13-year averages, are tabulated and briefly discussed. "The season of 1921 was very favorable for the production of corn, but the extremely hot weather during the latter part of June and the first half of July reduced the yields of all small grain crops very materially, and on the average farm the yields, with few exceptions, were very disappointing."

Report of weather observations, C. H. STEELMAN (*New Jersey Sta. Rpt. 1921, pp. 100-102*).—Observations on temperature and precipitation at the agricultural farm at New Brunswick, N. J., are summarized.

"The year ended June 30, 1921, was unusual, having a warm fall and a very early spring. The first killing frost occurred November 12, which is the latest on record for this locality. The monthly means for March and April were higher than ever recorded here, being 50.06 and 57.1° F., respectively. The rainfall for July and August, although not heavy, was well distributed throughout the months because of the unusually large number of thunderstorms. The winter was very mild and open, having but one heavy snowfall of 10.5 in., which occurred February 20 and lasted one week only. The sudden drop of the thermometer from 82 to 45° in less than an hour on March 28, continuing during the night to 24°, caused severe damage to fruit crops. From May 15 to June 28 was the driest period on record, there being only 0.97 in. of rainfall in the six weeks. From June 1 to 28 there was only 0.23 in. of rainfall. The mean temperature for the year was 54.97°, the highest on record. The next highest mean temperature recorded was in 1918-19, with 54.91°." The total precipitation for the year was 47.04 in., as compared with a normal of 48.76 in.

Weather observations, L. SMITH (*Virgin Islands Sta. Rpt. 1921, pp. 11, 12*).—A table is given which summarizes temperature, precipitation, and evaporation of each month of 1920 and the first six months of 1921 at the experiment station on St. Croix. The weather during this period "was abnormally dry, only 48.66 in. of rain falling during the whole of 1920 and the first six months of 1921. A large part of the rain fell in showers of less than half an inch, which was ineffectual for growing purposes, and evaporation more than doubled precipitation."

SOILS—FERTILIZERS.

Soil survey of Mitchell County, Ga., D. D. LONG ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1920, pp. III+37, fig. 1, map 1*).—This survey, made in cooperation with the Georgia State College of Agriculture, deals with the soils of an area of 323,840 acres lying within the Coastal Plain in southwestern Georgia. The topography of the area is level to rolling, and the uplands are generally well drained, although poorly drained sloughs, sinks, and streamways are numerous. The surface soils of the county are predominantly sandy and are gray, grayish brown, and brown in color. The subsoils are more variable in texture and color, ranging from a light gray sand to a very heavy plastic red clay. Including swamp, 22 soil types of 12 series are mapped, of which the Norfolk sandy loam and sand and the Tifton sandy loam cover 26.3, 15, and 15 per cent of the area, respectively.

Soil survey of Iowa—Palo Alto County, W. H. STEVENSON, P. E. BROWN, ET AL. (*Iowa Sta. Soil Survey Rpt. 22 (1922), pp. 62, pl. 1, figs. 10*).—This survey deals with the soils of an area of 359,040 acres lying within the Wisconsin drift soil area in northern Iowa. The topography of the county is generally gently undulating to rolling. Drainage is considered to be one of the most important treatments necessary for the development of a higher state of fertility.

The soils of the county are grouped as drift, terrace, and swamp and bottomland soils. Including peat and muck, 15 soil types are mapped, of which the Clarion loam and Webster loam drift soils and the Lamoure silty clay loam, swamp and bottomland soil cover 37.7, 28, and 14.4 per cent of the area, respectively.

Laboratory, greenhouse, and field experiments to determine the fertility requirements and crop adaptations of the prevailing soil types are also reported. The soils of the county are said to be quite generally well supplied with organic matter and nitrogen, but the phosphorus content is not high in any case, although it is not extremely low. A few of the soils are said to be acid and in need of lime.

Soil survey of Decatur County, Ind., I, II (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. III+32, fig. 1, map 1*).—Part 1 of this report covers a survey, made by M. Baldwin et al. in cooperation with the Indiana Experiment Station, dealing with the soils of an area of 227,200 acres in southeastern Indiana. The topography varies from flat to undulating, rolling, and hilly. The drainage for the most part is said to be well established. The soils of the county are grouped as upland terrace and first bottom soils and are largely of glacial and alluvial origin. Eight soil types of 8 series are mapped, of which the Miami, Cincinnati, and Clermont silt loams cover 58.4, 14, and 13.7 per cent of the area, respectively.

Part 2 of this report, a contribution by A. T. Wiancko and S. D. Conner, from the Indiana Station, presents information on the fertility requirements and crop adaptations of the soils of Decatur County, based upon chemical analyses of the prevailing types. It is shown that the Miami silt loam, the prevailing soil type, is usually the most deficient in phosphorus, lime, nitrogen, and organic matter.

Soil survey of Frederick County, Md., W. J. LATIMER ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. IV+82, fig. 1, map 1*).—This survey, made in cooperation with the Maryland Geological Survey and the Maryland Experiment Station, deals with the soils of an area of 424,320 acres lying within both the Appalachian region and the Piedmont Plateau region in north-central Maryland. The chief physiographic features consist of two parallel mountain ranges, South Mountain and Catoctin Mountain, extending northeast and southwest across the western part of the county; the Middletown Valley and the intermountain region lying between these ranges; the Monocacy Valley lying east of Catoctin Mountain; and the low rolling Linganore Hills region south and east of this valley. The topography of the mountain region is steep and broken, that of the valleys is comparatively smooth, and that of the Linganore Hills rolling to hilly. Practically all of the county is said to be well drained with the exception of a few spots in the vicinity of Lewistown and Thurmont.

The soils of the county are prevailingly light in color, ranging from light brown or yellowish brown to red or reddish brown. All of the mature soils of the county are said to be deficient in organic matter. Including rough stony land, 42 soil types of 27 series are mapped, of which the Penn silt loam, constituting 10.6 per cent of the area, is the most extensive individual type.

Soil survey of the White Plains area, N. Y., C. VAN DYKE and J. H. BROMLEY (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. III+44, fig. 1, maps 2*).—This survey, made in cooperation with the New York State College of Agriculture, deals with the soils of an area of 547,840 acres comprising Westchester, Putnam, and Rockland Counties in southeastern New York. The area comprises three quite distinct physiographic divisions: (1) A hilly to mountainous division, including mainly the part lying within the region known as the Highlands of the Hudson and consisting of a series of more or less parallel ridges of rugged topography, (2) a rolling to hilly region, the surface of which is made up of a series of hills of smooth, rounded to rugged outline, grouped between streams having a nearly north-south or north-

east-southwest direction, and (3) a gently to broadly rolling division. There are said to be only local poorly drained areas.

The soils are of glacial, old alluvial, recent alluvial, and miscellaneous origin. Including rough stony land, muck, meadow, tidal marsh, and madeland, 20 soil types of 10 series are mapped of which the Gloucester loam, rough stony land, and Gloucester stony loam cover 39.1, 19, and 18 per cent of the area, respectively.

Soil survey of Nicholas County, W. Va., S. W. PHILLIPS (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1920, pp. III+31, fig. 1, map 1*).—This survey, made in cooperation with the West Virginia Geological Survey, deals with the soils of an area of 420,480 acres in south-central West Virginia which lies wholly within the Cumberland Plateau division of the Appalachian province. The topography is generally hilly to broken. All of the county is said to be drained into the Kanawha River.

The soils are of residual and alluvial origin. Analyses of virgin and cultivated soils to determine organic matter content are included. Five samples of forest soil showed an average content of 2.01 per cent of carbon, while five samples of cultivated soil (corresponding types) showed an average carbon content of 2.27 per cent. The sample of lowest carbon content as well as that of highest was from a forested area, but on the whole the virgin and cultivated soils showed no consistent difference as regards their carbon content. Including rough stony land, 12 soil types of 6 series are mapped, of which the Dekalb stony silt loam, silt loam, and stony loam cover 39.3, 31.4, and 17.6 per cent of the area, respectively.

Absorption by colloidal and noncolloidal soil constituents, M. S. ANDERSON, W. H. FRY, P. L. GILE, H. E. MIDDLETON, and W. O. ROBINSON (*U. S. Dept. Agr. Bul. 1122 (1922), pp. 20*).—This paper deals chiefly with the absorptive capacities of the noncolloidal soil particles for malachite green, water, and ammonia. The absorption of such particles is compared with the average absorptive capacities of the ultra clays extracted from different soils. Various colloidal mineral powders and synthetic gels were also tested for absorption in order to throw light on the nature of the soil colloids.

It was found to be impossible to determine directly the amount of absorption in soils due to colloids and noncolloids from a fractionation of the soil into these two classes of material, since not all of the colloidal matter could be separated from the finer mineral particles.

"Since the noncolloidal part of soils is made up of minerals of different degrees of fineness, it should be possible to calculate the magnitude of the noncolloidal absorption in the soil from the absorptive capacities of minerals powdered to definite sizes. Each mineral has a characteristic absorptive capacity for different substances. Several of the most abundant minerals in soils, such as quartz and the feldspars, absorb practically no malachite green, water, or ammonia.

"It was calculated from the absorption of mineral powders and the mineralogical compositions of soils that as a rule less than 5 per cent of the total absorption of the soil is due to the noncolloidal part. In the case of the most highly micaceous soils, however, the noncolloidal absorption might reach 10 to 20 per cent of the whole soil absorption. Absorption by noncolloidal constituents should, therefore, not seriously affect absorptive methods for determining the amount of colloids in soils.

"Evidence concerning the nature of the soil colloids is afforded by the absorptive capacities of various substances. Minerals ground to a state of subdivision probably equal to that of the mixed soil colloids, or 'ultra clays,' absorbed less than the average ultra clay. The average absorption of peat and

synthetic inorganic gels, on the other hand, was more nearly like that of the ultra clays. Since soil colloids appear to be of quite a different nature from the noncolloidal particles, and not merely finely comminuted minerals it is understandable why such a large part of the absorption of a soil should be localized in the colloidal matter."

Studies on active bases and excess acids in mineral soils, C. H. SPURWAY (*Michigan Sta. Tech. Bul.* 57 (1922), pp. 3-27, figs. 11).—Studies to determine the neutralizing value of mineral soils for acids and alkalis by means of the hydrogen electrode and indirect titration are reported.

It is concluded that the neutralizing value of mineral soils for acids and alkalis may be determined quite accurately, and methods for doing this are outlined. When soils were treated with calcium hydroxid, the reaction proceeded slowly and reached an equilibrium at a pH value of 7 with the quantity of calcium hydroxid required to raise the pH value of soils to this point in at least 24 hours, but in the presence of an excess of calcium hydroxid an equilibrium was not reached, indicating that this further reaction is continuous over a long period of time. Calcium hydroxid formed salts with the soil acids.

It is further concluded that a soil-acid equilibrium may be obtained in a short period of time in the presence of an excess of acid, and this equilibrium is quite constant over a period of several days, showing that a rather sharp distinction may be made between reactive and inactive soil bases. Weak soil acids are split off when soils are treated with strong acids. When the methods devised for determining active bases and excess acids in soils were applied to a series of soils of varying pH value, no direct relationships were discovered between soil class, active bases, excess acids, and pH values. However, a direct relationship was exposed between the base-acid ratio and pH value of the soils. The pH value and base-acid ratio plotted as a curve corresponded to the normal H-ion concentration curve obtained in weak acid-alkali titrations. The quantities of lime required to neutralize a series of miscellaneous soils did not correlate with their degree of acidity. The base acid ratio in soils is believed to be of great practical importance.

The growth of fungi in the soil, S. A. WAKSMAN (*Soil Sci.*, 14 (1922), No. 2, pp. 153-157).—Studies conducted at the New Jersey Experiment Stations on the growth of fungi in the soil are reported. A number of fungi were found to exist in the soil in the form of vegetative mycelium. The majority of the organisms isolated by this method were found to belong to the Mucorales and were included in the genera *Mucor*, *Rhizopus*, and *Zygorhynchus*. Such large groups of soil organisms as the *Penicillia*, *Aspergilli*, and *Cladosporia* were not obtained at all or only in very few instances by this method.

The method used for demonstrating fungi is as follows: A clump of soil the size of a large pea, taken out carefully from the soil sample with as little contamination from the air as possible, is placed in the center of a sterile plate into which 10-12 cc. of a sterile nutrient agar, favorable for the development of fungi, has been placed; the soil is slightly pressed into the agar, so as to be surrounded by the nutrient medium. The plates are incubated at 25 to 30° C. and examined at the end of 24 to 26 hours' incubation. By this method mold hyphae were found to radiate out of the clump of soil into the surrounding medium. This is attributed to the fact that the fungi present in the soil in the form of mycelium will grow at once into the medium before the spores can germinate and develop hyphae. When a small piece of agar containing the growing mycelium was transferred upon a sterile slant of agar, practically a pure culture of the particular fungus could be obtained.

One of the most common soil fungi found in the soil by this method was a species of *Zygorhynchus* closely related to *Z. vullemintii*. This fungus was found by the direct method in practically all of the soils examined, whether the soil was rich or poor in organic matter, or acid, neutral, or alkaline in reaction. The organism was also found abundantly in subsoils, particularly sandy subsoils. Invariably a pure culture of this organism was obtained by placing a clump of sandy subsoil, even from a depth of 30 in., upon the plate.

Studies of a nearly pure white sand soil typical of the New Jersey pine barrens and having a reaction equivalent to pH 6.2 showed that the common soil *Zygorhynchus* was the organism, the mycelium of which penetrated the sand to such an extent as to hold it in a compact mass. Other instances of the activity of fungi on the soil are described.

In studies of the variability of numbers of microorganisms in the soil as determined by the plate method, it was found that when the numbers of fungi are determined on the plates prepared for the count of bacteria and actinomycetes the variability is so great, due to the high dilution of the soil and, therefore, to the small number of fungi obtained, that the probable error obtained even from as many as 50 plates prepared from one soil is so large as to make the results worthless. Where low dilutions of the soil were employed, so many bacteria developed on the plate as to actually crowd out a good many fungi and make the count entirely unreliable.

It was found that by the use of special acid media, on which no bacteria or actinomycetes will develop, and of low dilutions, the numbers of fungi could be determined quite accurately. Two of the acid media used are described, with which plates were obtained containing only fungus colonies.

By this method the numbers of fungi present in the soil were found to be lower than with other methods, and the results were more definite and less variable. In addition, a definite correlation was found between soil treatment, soil reaction, and numbers of fungi in the soil. Manure and acid fertilizers stimulated an increase in the numbers of fungi. Liming, resulting in a less acid reaction, caused a great decrease in the numbers of fungi.

Nitrogen fixation in arid climates, B. H. WILSON and B. ALI (*Soil Sci.*, 14 (1922), No. 2, pp. 127-133, fig. 1).—In a contribution from the Punjab Agricultural College, India, the results of studies on nitrogen fixation in certain arid soils are summarized. The progress results of an extensive series of laboratory studies begun in 1919 on nitrogen fixation in certain soils of the Punjab are also briefly reported.

The most marked and uniform fixation with all soils and under all conditions of incubation took place in September. It is concluded that the date of sampling is of the utmost importance in estimating the nitrogen-fixing powers of a soil in the laboratory. There appeared to be a definite seasonal influence which must be taken into account. The results so far obtained did not permit the formation of an opinion as to the effect of the partial sterilization possible in arid soils under ordinary cultural conditions. In some cases the fixation was greater in cultivated soils and sometimes the reverse. The results were conclusive, however, in showing that it is not until after a prolonged period of dry heat that the soil becomes capable of considerable nitrogen fixation. It also appeared that a period of rapid nitrogen fixation is followed by an almost equally rapid loss.

Fertility of burned virgin mineral soil, M. J. THOMPSON (*Minnesota Sta., Duluth Substa. Rpt.* 1921, pp. 26, 27).—Two years' observations on the productivity of burned-over virgin mineral soil seemed to indicate that the first year's crop was subnormal, except in the case of sunflowers, but that the second year's

crop was about normal with the possible exception of potatoes. Grass did best on well-drained upland soil which had been burned over.

Delayed clearing plats, M. J. THOMPSON (*Minnesota Sta., Duluth Substa. Rpt. 1921, pp. 27, 28*).—A study begun in 1920 to compare the influence of immediate clearing with that of delayed clearing on soil fertility are briefly reported.

It is stated that at the close of the second year the delayed clearing plats were distinctly more productive than any other group of new land plats handled otherwise. Burned upland soil was almost normal in production. A brief summary of soil fertility data indicates that the use of neither rock nor acid phosphate has yet been justified, and that smaller applications of manure have been more efficient than larger ones.

Soil fertility and soil management experiments, C. G. SELVIG (*Minnesota Sta., Crookston Substa. Rpt. 1921, pp. 26-50*).—The results of seven different experiments in soil fertility and soil management are presented and discussed.

Six years' continuous cropping to wheat, oats, and barley without fertilization or a legume crop showed only slight changes in the yields of wheat and oats, but a gradual marked decrease in the case of barley.

In a 4-year rotation without manure, fertilizer, or legume, including wheat, oats, corn, and potatoes, it was found that in the first three years of the second cycle there was a difference of 0.8 bu. of wheat, 5.4 bu. of oats, 6 bu. of corn, and 507 lbs. of corn stover per acre in favor of a rotation including a legume. There was an increase in the yields of corn and wheat in the second cycle over the first cycle without manure, fertilizer, or legume, but a marked decrease in the yields of potatoes, oats, and barley.

A 4-year rotation of wheat, clover, oats, and cultivated crops, using manure and phosphates both singly and combined, showed that acid phosphate, rock phosphate, and manure, and combinations thereof, had no influence on the yields of corn or stover over an 8-year period. The average yields of potatoes were somewhat higher in all the treatments with phosphate and manure than on the unfertilized plats, but the variations in each year among the plats receiving the same treatment were so great that not much weight could be attached to the differences in the averages shown for the four years.

Both wheat and clover showed more effect of treatment with acid phosphate and manure than corn and potatoes, although no fertilizer was added directly to either of the two former crops but was applied immediately preceding the two latter. Wheat especially was distinctly benefited by the phosphate. Both the manure and phosphates increased the yields of clover and sweet clover, especially acid phosphate in combination with manure. The oat crop showed no distinct benefit from any of the treatments.

In every case with the small grains, except with acid phosphate on oats and wheat and rock phosphate without manure on wheat, there was a more marked difference between the average yields of the fertilized plats and those of the check plats during the last three years than during the first four years.

In a 3-year rotation experiment including barley, clover, and cultivated crops treated with complete fertilizers and manure, the 3-year average yields of clover hay were greatest from a combination of potash and phosphates. Of the single elements applied, phosphate produced the greatest yield. Potash produced the largest yield of seed in a 1-year trial of oats and peas and in a 2-year trial of sunflowers. Phosphate produced the greatest gain in 7-year trials with barley. Phosphate and potash produced the largest yield of corn during six years.

An experiment on the use of different amounts of manure in a 4-year rotation of wheat, clover, oats, and cultivated crops showed that the largest yields of corn were obtained with an application of 16 tons of manure applied on oats

and wheat stubble, of corn stover 32 tons, of wheat 16 tons, of wheat straw 4 tons, and of oats 32 tons. In every case the largest increase per ton of manure resulted from the 4-ton applications.

An experiment on the use of different amounts of wheat straw on a 2-year rotation of wheat and cultivated crop, the straw being either plowed under or first burned showed that as an average of five years there was an increase of 2.7 bu. of corn per acre for 2 tons of straw per acre burned on the plat. There was no increase in wheat.

A 4-year rotation of clear summer fallow, wheat, oats, and barley to show the influence of fallow on these crops when no manure, fertilizer, or legume is used showed that as an average of four years wheat yielded 2.7 bu. more after fallow than following barley after oats. Oats yielded 10.4 bu. more after fallow than following wheat after fallow. Barley yielded 13.7 bu. more after fallow than following oats after fallow.

Soil fertility investigations, M. J. THOMPSON (Minnesota Sta., Duluth Substa. Rpt. 1921, pp. 17-20).—In a further report of soil fertility investigations (E. S. R., 47, p. 121), it is stated that over a 6-year period manure, rock phosphate, and acid phosphate each increased the yield of potatoes. While the yields seemed to indicate that manure and either rock or acid phosphate are both more effective when used together than when either is used alone, the manure is considered to be probably the more active agent of the two. There seemed to be no material difference between the rock and acid phosphate, and although some increase in production can be attributed to these fertilizers, it is considered to be very questionable if their cost will justify their use on potatoes. Somewhat similar results were obtained with rutabagas, oats, and hay, indicating a slight superiority for either manure or acid phosphate.

[Fertilizer experiments at the Morris, Minn., Substation, 1921], P. E. MILLER (Minnesota Sta., Morris Substa. Rpt. 1921, pp. 9-21).—Further results of phosphate fertilizer experiments previously described are presented (E. S. R., 47, p. 124). It is stated that acid phosphate has improved wheat and oats production continuously for a period of six years. Both manure and rock phosphate were less effective than acid phosphate on wheat. A combination of either acid or rock phosphate with barnyard manure gave the best results with corn. Either phosphate alone or in combination with barnyard manure increased the yield of clover.

Fertilizer experiments with alfalfa begun in 1915 have so far given no noteworthy increases due to the use of fertilizer except in the cases of acid phosphate and manure. Information is presented on cooperative phosphate tests in 1921 and on how to use acid phosphate.

Experiments on rates of manuring best adapted for ordinary farm crops begun in 1916 have so far indicated that the heavier applications are apparently not practical.

Experiments on the fertilizing value of wheat straw and corn stover when plowed under, using a 2-year rotation of corn and wheat, showed that as an average of 6 years a 1-ton application of straw gave slightly higher yields of corn than did the heavier amounts. Very slight differences were noted with wheat following corn stover with either heavy or light applications.

Investigational work with fertilizers, F. T. SHURT (Canada Expt. Farms, Div. Chem. Interim Rpt., 1921, pp. 5-12).—In continuation of work previously noted (E. S. R., 45, p. 815), crop rotation studies, the ultimate object of which is to ascertain the influence of various fertilizer treatments on the development and yields of apple trees, are reported. A 3-year rotation consisting of potatoes, grain, and clover hay is followed. The soil is a light sandy loam, and the fertilizers were applied to the first and second crops of each rotation.

Of the materials applied singly, basic slag was the most effective except on potatoes, where sodium nitrate gave the best results. The most pronounced influence of basic slag was noted in the clover crop, while the increases throughout an 8-year period from the addition of sodium nitrate have been no less striking. While potash alone gave practically no increase, its influence when added with nitrogen and phosphoric acid was quite distinct.

In a second series it was found that complete fertilizers compounded of sodium nitrate, superphosphate, and potassium chlorid gave the largest profits for potatoes. Sodium nitrate and basic slag gave results on the hay crop but slightly inferior to those given by the maximum application of complete fertilizers.

Studies on light sandy loam soil with a rotation of potatoes, grain, and clover hay, to determine the influence of ground limestone when used in conjunction with commercial fertilizers and to compare sodium nitrate with ammonium sulphate as a source of nitrogen and basic slag with superphosphate and bone meal as a source of phosphoric acid, are also reported. Throughout the studies sodium nitrate was superior to ammonium sulphate as a source of nitrogen, while basic slag was the most effective source of phosphoric acid, especially on the hay crop. Once during the seven years' studies ground limestone failed to increase the yield of potatoes, and except in two series it had a depressing effect. This is attributed to the early ripening of the potatoes, in consequence of which they derived less benefit from the late rains.

On a silty clay soil, studies to ascertain the influence of basic slag, of lime in various forms, and of superphosphate in conjunction with sodium nitrate, and sometimes potash, on crop yields in a 4-year rotation of potatoes, grain, clover hay, and timothy hay showed that basic slag produced notable increases, and the medium quantity used was the most profitable. Ground limestone gave better results than caustic or slaked lime. An application of 1,000 lbs of caustic lime was found to be distinctly beneficial when used in conjunction with a nitro-phosphatic fertilizer.

Results with superphosphate alone indicated that it can not be depended on to promote the maturity or increase the yields of corn or cereals. The small yields of oats on plats receiving no sodium nitrate were attributed to a lack of soluble nitrogen in the soil.

Pot culture experiments, 1921. J. A. VOELCKER (*Jour. Roy. Agr. Soc. England*, 82 (1921), pp. 286-297, pls. 4; also in *Woburn Expt. Sta. Rpt. 1921*, pp. 13-24, pls. 4).—The progress results of these studies are presented in detail and discussed (E. S. R., 46, p. 716).

Studies of the influence of potassium chromate and bichromate on a second crop of barley showed that during the second year the result is one of a stimulating rather than of a toxic nature, this extending to the use of 0.01 per cent of chromium. With as much as 0.025 per cent of chromium the toxic effect continued to be very marked for the second year. The toxic action of the bichromate was more marked than that of the chromate of potassium.

On wheat, 0.005 per cent of chromium in the form of chromate or bichromate of potassium proved toxic, the bichromate being more so than the chromate. Chromium in amounts less than 0.005 per cent, either as chromate or bichromate of potassium, had a stimulating influence. Chromium chlorid was on the whole harmful, while chromium sulphate was neutral in effect. Chromic acid, while at first seemingly harmful, became ultimately extremely stimulating. It is not, however, considered safe to use it in a concentration of 0.005 per cent or over.

Studies of the relative effects of lime and chalk on barley and wheat showed, as in preceding years, a gradual increase as more lime was added up

to 4 tons per acre. There was also an increase with chalk but a smaller and more gradual one. It is considered probable that caustic lime retains its action as such or becomes converted into calcium silicate or some other form in which it can continue to exert its influence. It is concluded that in considering the lime requirements of a soil the amount of lime present in the form of calcium carbonate is not the determining factor but rather the total lime present.

Magnesium silicate showed some influence on wheat in the second year, although this was not so marked as that of calcium silicate. Kaolin, however, had no effect.

While potassium fluorid added in amounts equivalent to 0.1 per cent of fluorin produced a fourfold crop of wheat sodium fluorid absolutely killed all plants. In addition, the sodium fluorid entirely transformed the aggregation of the soil particles and gave the surface the appearance of a clay soil instead of a very sandy one. Sodium fluorid in smaller quantity eventually produced a very heavy increase in crop, but this was only after the early destruction of some of the plants, and the soil change was the same as with the heavier application, although not so marked. Calcium fluorid was used without benefit, but there was a fair increase from the use of calcium-silicofluorid.

Studies on the relative effects of chemically prepared and natural forms of magnesium carbonate showed that with wheat no benefit was derived from the several treatments, and no difference was brought out between the chemically prepared magnesium carbonate and the mineral magnesite. Dolomite did not produce any benefit. It was found, however, that while the prepared carbonate and the magnesite could be used safely up to 4 tons per acre, an application of 6 tons per acre practically destroyed the crop. Dolomite was used in amounts up to 6 tons per acre without harm.

Studies on the effect of ferrous oxid on wheat confirmed the results of the previous year

Experiments on the use of leucite as a source of potash on sandy loam and chalky soils using wheat, lucern, grass, and potatoes as crops are also reported. The results with wheat show that in each case there was a gain from the use of potash, either in the form of leucite or potassium sulphate, which was about the same in both grain and straw. The crops receiving leucite were never behind those receiving potassium sulphate and were, if anything, slightly better throughout. These results are taken to indicate that with wheat leucite is as useful as potassium sulphate as a source of potash. No final results were obtained with the other crops.

The continuous growing of wheat and rye with and without a legume as a green crop, season 1920, J. G. LIPMAN and A. W. BLAIR (*New Jersey Stas. Rpt. 1921, pp. 316-318*).—In a further contribution to the subject (*E. S. R.*, 46, p. 514) it is reported that during 1920 the yields on the legume-treated plats were again distinctly higher than on the nonlegume plats. The straw yields and nitrogen content were also greater on the legume plats. The increases were not so great on the wheat plats as on the rye plats.

The continuous growing of corn with a legume and a nonlegume green manure crop, season 1920, J. G. LIPMAN and A. W. BLAIR (*New Jersey Stas. Rpt. 1921, pp. 318-320*).—In a further contribution to the subject (*E. S. R.*, 46, p. 514) it is reported that during 1920 the yields from the legume plats were distinctly larger than those from the nonlegume plats. The yield of nitrogen was also considerably greater on the legume plats. Plats treated with manure yielded more dry shelled corn than the checks. These results are considered to be favorable to a legume cover crop where conditions will

permit. It is suggested in this connection that sweet clover appears to be one of the hardest of the legume crops and is well adapted for this purpose.

Rate of manuring, M. J. THOMPSON (*Minnesota Sta., Duluth Substa. Rpt. 1921, pp. 23-26*).—In a further report of rate of manuring studies (E. S. R., 43, p. 627), in which manure was applied at rates of 5, 10, and 20 tons per acre to a virgin clay soil in oats stubble as part of a 3-year rotation of oats, clover-timothy, and potatoes-sunflowers, it is stated that increasing the amount of manure had little influence on potato yields. Sunflowers reacted quite readily to manure as a fertilizer. The larger manure applications gave the most striking increases in yield of oats and hay.

The influence of the mechanical composition of the soil on the availability of nitrate of soda and dried blood, 1920, J. G. LIPMAN and A. W. BLAIR (*New Jersey Stat. Rpt. 1921, pp. 303-316, figs. 3*).—This constitutes the final report of this study and completes a 10-year period during which the two forms of nitrogen have been compared in soils varying in mechanical composition from a loam to a pure coarse sand (E. S. R., 46, p. 519).

With the exception of the 80-100 per cent sand series the crop yields and the nitrogen recovery have usually been in favor of the sodium nitrate. In a few cases even the 80 per cent sand mixture has yielded more with nitrate than with blood. Neither the nitrate nor the blood has shown high residual effects, but the blood has usually surpassed the nitrate in the case of crops grown for the residual effect. However, the initial effect of the nitrate has usually been sufficiently in advance of the initial effect of the blood to carry the total effect of the former beyond that of the latter except in the case of the 80-100 per cent sand series. The reason for the superiority of the nitrate over the blood seems to be its ability to give the plant a good start during its early growth.

"It has been quite common to regard the organic sources of nitrogen as having a more permanent and lasting effect than the mineral sources, the latter having been regarded as subject to rather rapid loss through leaching. The results of this experiment do not bear out this idea, except in the case of soils which are almost pure sand. It would appear that the young growing plant rapidly utilizes the nitrogen of soluble nitrates and thus forges ahead of the plant which is depending upon sources not so readily available. It is possible that during the transformation of the nitrogen of these slowly available materials into soluble forms there is a considerable loss."

Liming an acid muck soil, P. M. HARMER (*Mich. Sta. Quart. Bul., 5 (1922), No. 2, pp. 74-78, figs. 2*).—This is a general discussion of the reclamation of areas of acid muck soils in which an experiment on the use of lime on such soil is briefly described. Liming apparently increased the yield of rye, clovers, sugar beets, millet, and potatoes on these soils.

Borax fertilizer experiment with corn and potatoes (*New Jersey Stat. Rpt. 1921, p. 21*).—The results of an experiment begun in 1920, in cooperation with the U. S. D. A. Bureau of Plant Industry, to determine to what extent borax in the fertilizer will prove injurious to potatoes and corn are briefly presented. A standard 4-8-4 fertilizer was used for potatoes, to which anhydrous borax was added in amounts varying from 1 to 400 lbs. per acre.

When the borax was applied two weeks before planting the injury was much less than when applied at the time of planting. With amounts of borax up to 30 lbs. per acre the injury was slight. Applications of 50 lbs. or over per acre had a distinct depressing effect with respect to both germination and growth. The effect of the borax on the corn was quite similar to its effect on the potatoes. It is probably slightly more toxic to the former than to the

latter. The cover crop of rye which followed the potatoes did not appear to be injured even where the applications of borax amounted to 200 and 400 lbs. per acre.

Some relations of arsenic to plant growth, I, II, J. STEWART and E. S. SMITH (*Soil Sci.*, 14 (1922), No. 2, pp. 111-126, figs. 2).—Studies conducted at the Utah Experiment Station on the solubility of arsenic compounds in different salt solutions and in soil solutions and on the absorption of arsenic by plants in pot experiments are reported.

Part 1 deals with the solubility of arsenic in solutions of each of several salts in two concentrations. Lead arsenate was found to be a very insoluble compound. Only three parts of arsenic dissolved in a million parts of pure water. Its solubility was greatly increased by many common salts when these were present in the aqueous solvent, but sulphates and nitrates did not seem to increase materially the solvent power of water for lead arsenate. Acid salts and those which hydrolize with an alkaline reaction markedly increased the solvent action of water on lead arsenate. The soil solution also had a greater solvent power for lead arsenate than had pure water.

Part 2 contains the results of small-scale pot experiments conducted with peas, radishes, wheat, potatoes, and beans on a gravelly bench loam soil. Disodium arsenate in low concentrations was visibly stimulating to all of the plants tested. This visible result was indicated in the underground part of radishes and not in the foliage. The evidence of stimulation or nonstimulation shown by the dry weights was inclusive but indicative of stimulation where the concentration of the arsenate was low, and in the case of radishes in all the concentrations tested. This is taken to indicate that the accumulation of arsenic in the soil, as the result of the spraying of orchards, if not continued to excess, may be beneficial rather than injurious.

AGRICULTURAL BOTANY.

The influence of volume upon the rate of change in the hydrogen-ion concentration of nutrient solutions in contact with plant roots and the effect of this change upon iron availability, R. M. BARNETTE (*New Jersey Stat. Rpt.* 1921, pp. 345-347).—Experiments are reported upon in which Marquis spring wheat was grown in Tottinham 4-salt solution, and a modification of this solution by the substitution of ammonium sulphate for potassium nitrate in equivalent osmotic concentrations. The plants were grown in culture bottles of 250, 500, 1,000, and 2,000 cc. capacities. Iron in the form of an aqueous suspension of ferric phosphate was added at the rate of 5 mg. per liter of solution. A single wheat plant was grown in each culture for a period of 36 days, culture solutions being renewed at regular intervals of 3.5 days.

In the Tottinham solution, it was found that the H-ion concentration decreased very rapidly in the 250-cc. cultures, while the decrease was progressively less rapid in the others. Chlorosis appeared in the plants grown in the flasks of the smallest capacity in about 20 days. In the 500-cc. flasks they became chlorotic about the twenty-third day, and in the 1,000-cc. cultures no indication of yellowness of the leaves appeared before the twenty-sixth day. In the plants of the 2,000-cc. series there was only a slight indication of chlorosis at the end of the growing period.

The average total dry weights of plants were determined in the different solutions as well as the change in the H-ion concentration, and it was found that the H-ion concentration of the modified solution was increased, as the result of contact with the plant roots, during the growth intervals covering a period of 3 weeks in the 250-cc. cultures, and then it was rather suddenly

reversed in the direction of the change in reaction. The reversal in the change of the H-ion concentration was progressively delayed with the larger volumes of nutrient solution. Plants grown in 250 cc. of the solution containing ammonium sulphate developed chlorosis about the thirtieth day, while in the plants of the 500-cc. cultures a slight chlorotic condition appeared during the last interval, and chlorosis did not appear in the other cultures. A marked decrease in the H-ion concentration was apparent in the modified solution as well as in the unmodified Tottingham solution following the appearance of a chlorotic condition in the plants. It is believed that the ability of the plants to obtain sufficient iron from the nutrient solution for normal development is determined in large measure by the H-ion concentration of the solution.

From a study of the dry-weight data, it is shown that the average total yields were progressively higher as the volumes of the solutions increased, and this was directly correlated with a corresponding delay and a lower degree of intensity in the development of the chlorotic condition of the plants. The average yields from the unmodified solution were always lower than the average yields from the corresponding volumes of the solution containing ammonium sulphate, and this is considered to be due probably to the higher availability of iron in the latter solution, which prevented the development of chlorosis.

Some factors affecting the rate of change of hydrogen-ion concentration in nutrient solutions, L. H. JONES (*New Jersey Stat. Rpt. 1921, pp. 330-333*).—Studies are reported of the influence of total concentration, volume of solution, and varying numbers of plants upon the rate of change of the H-ion concentration in a Shive's 3-salt solution in contact with the roots of growing plants. Soy bean and wheat plants were grown in the solution, but as the results are very similar only those for wheat are stated.

The results show that (1) with each number of plants used in a given volume of nutrient solution the rate of change of the H-ion concentration decreased with an increase in the total osmotic concentration value of the solution; (2) with each number of plants grown in the nutrient solution having a given total osmotic concentration value the rate of change of the H-ion concentration decreased with each increase in the volume of the solution; and (3) with each volume of nutrient solution and with each total osmotic concentration the rate of change of the H-ion concentration increased with each increase in the number of plants grown in the solution. Wheat plants changed the H-ion concentration of the solution from the initial pH values of 4.9, 4.5, and 4.3, corresponding to osmotic concentration values of 0.1, 1.75, and 2.50, respectively, to a pH value slightly below the neutral point. The time required to produce the maximum change differed for each number of plants, for each total concentration, and for each volume of the nutrient solution employed.

The salt requirements of the soy bean plant during the seedling phase, J. W. SHIVE, A. L. PRINCE, R. V. ALLISON, and S. WAKABAYASHI (*New Jersey Stat. Rpt. 1921, pp. 327-330, fig. 1*).—A summary is given of the main results of a study of the salt requirements of the soy bean plant during the early stages of growth to the flowering period. Three complete series of 21 cultures each were conducted for 35 days, a 3-salt solution being used, and the plan of the experiment was the same as that previously described (*E. S. R.*, 44, p. 130). Only the results obtained from those cultures which produced the highest yields of tops and roots are given.

Attention is called to the fact that all the cultures which produced low yields of either tops or roots were characterized by having high proportions of calcium nitrate and correspondingly low ones of magnesium sulphate. As

a result of the experiments it is believed that these salts are the determining factors in the production of either high or low yields, and that monopotassium phosphate had much less influence on the growth rates of soy bean plants during the early stages of development than either of the other two salts.

The relation of aeration to the development of the soy bean plant in artificial culture. R. V. ALLISON (*New Jersey Stas. Rpt. 1921, pp. 338-344, figs. 2*).—A summary is given of a study of the relation of aeration or the lack of it to the development of the soy bean plant in artificial culture media. Soy beans were grown in simple solution cultures, simple sand cultures, simple solution cultures aerated by constant bubbling of air through the medium, drip solution cultures, and drip sand cultures. The culture solution used was one of the 3-salt solutions recommended by Shive.

The average dry-weight yields of tops, roots, and fruit, and the average total yields of the different cultures were determined, and it appears that the lowest average yields were produced by the simple sand cultures, while the simple solution cultures produced an average total yield almost twice as great. The aerated solution cultures produced an average total yield more than double that of the simple sand cultures, and the drip solution cultures gave slightly higher yields than those obtained from the aerated solution cultures. This is believed to indicate that the superiority of the average yield from the drip solution cultures was due to a better aerated condition brought about by the constant drip which not only carried some air with it into the solution, but also provided excellent opportunity for thoroughly aerating the new solution before entering the culture vessel. The highest average total yield was produced in the drip sand cultures.

An investigation was made of the nitrogen content of the various parts of the plant, and it was found in general that the percentage of nitrogen in the leaves, roots, tops as a whole, and the percentage of total nitrogen was always slightly lower for the plants of the simple solution and simple sand cultures than it was for the plants of the other series. In general, the highest percentage of nitrogen was found in the fruit and the lowest in the stems and roots. From analysis of the data presented, the author claims that the low nitrogen content of the stems is always correlated with high fruit yields, and a high nitrogen content with low yields of fruit. No such relation, however, was found for other parts of the plant.

The development of aleurone grains in ordinary vacuoles and formation of tannins. P. DANGEARD (*Compt. Rend. Acad. Sci. [Paris], 172 (1921), No. 16, pp. 995-997, figs. 9*).—In view of the previous observations of P. A. Dangeard (*E. S. R.*, 44, p. 822), the author considers the mitochondrion as probably a morphological phase and not at all an assemblage of elements having an individuality in the cell. Their similarity in appearance, though remarkable, does not necessarily involve a common origin for these formations, which probably differ as to chemical character.

The author reports briefly the results of his own studies on the formation of tannin in the epidermis of *Taxus baccata* and of *Pinus maritima*.

Disagreement is expressed regarding the view of Politis as to the origin of certain bodies (presumably tannic) in the transformation of granular mitochondria.

Aleurone grains are said to appear in adult vacuoles after passing through a filamentous or reticulate stage.

Enzym action in *Echinodontium tinctorium*. H. SCHMITZ (*Jour. Gen. Physiol.*, 2 (1920), No. 6, pp. 613-616).—In this, the second of the series of special investigations previously indicated (*E. S. R.*, 44, p. 27), the author was able to demonstrate the presence in *E. tinctorium* of esterase, maltase,

lactase, sucrase, raffinase, diastase, inulase, cellulase, hemicellulase, urease, rennet, and catalase.

The selective permeability of the seed coat, J. P. VAN DER MAREL (*Rec. Trav. Bot. Néerland.*, 16 (1919), No. 3-4, pp. 243-284, figs. 2).—Selective permeability in the seed coat is very widely met with among plants, occurring in the most diverse families. A good example is furnished by the seeds of *Cucurbita* and of *Cucumis*.

Acids, salts, and alkalis are, with some exceptions, arrested by the seed coats. Exceptions are indicated, though no cause has yet been found. A number of organic substances (alcohols, ethers, and chloroform) pass through readily.

The selective permeability of the seed membrane of *Cucurbita* and *Cucumis* should be attributed to a very thin membrane. Morphologically this membrane constitutes the cuticle of the nucellar epiderm, the chemical reactions of which, especially the manner in which it behaves toward colorants, organic solvents, and alkalis, are considered to show that it is probably formed of cutin.

Relation of seed weight to the rate of growth and size of crimson clover plants, D. SCHMIDT (*New Jersey Stat. Rpt.* 1921, pp. 333-335).—A preliminary report is given of experiments carried on to determine the relation of seed weight to plant growth. Seeds of a commercial strain of crimson clover were selected, weighed, and divided into three grades. These were planted February 1, and observations were made on germination.

It was found that the heavier seeds germinated earlier than those of lighter weight, and the first appearance of leaves followed in the same order as did the germination. Attention is called to the fact that the germination and formation of first foliage leaves of soy beans and buckwheat proceed in the reverse order from that just described of crimson clover. Data were obtained on the average dry weights of crimson clover plants from seeds of different weights, and it was shown that the average dry weight of the plants from the heavier seeds was always superior to that of plants from seeds of lighter weight.

***Zostera marina* in its relation to temperature,** W. A. SEICHELL (*Science*, 56 (1922), No. 1455, pp. 575-577).—From a study of *Z. marina* the author has found that the active period of growth and reproduction seems to be normally included within an interval of 10° C., i. e., from 10 to 20°. During the colder weather as well as the warmer periods of the year the plant was found to enter into a state of quiescence, but revived when the proper temperature was restored.

The author's investigations seem to indicate that there is no dependence, in the case of this plant, on a particular period of illumination so far as its various stages of growth and reproduction are concerned.

Changes wrought in the grapefruit in the process of maturation.—**I, Natural changes.** **II, Factors affecting the composition of the fruit,** F. A. LOPEZ (*Jour. Dept. Agr. and Labor Porto Rico*, 4 (1920), No. 4, pp. 103; 5 (1921), No. 4, pp. 45, pl. 1, figs. 4).—An investigation was conducted by W. B. Cady in 1916-17, the results of which were added to by his successor, the present author, who has referred to it in reports previously noted (*E. S. R.*, 42, p. 42), and who now presents the whole in systematized form in two parts. The first of these deals principally with the natural changes occurring in the composition of the fruit, and the second mainly with the factors which may affect such composition. The changes that take place in the fruit during its development, such as increase in juice content, increase in weight, and decrease in the proportion and thickness of the skin were found to become less and less perceptible as maturity approaches. Obvious signs of maturity, such as color of the fruit, condition of the juice cells, taste of the juice, and general appearance, coincide with cessation in the increase of weight and juice and the

decrease in the content of skin, as well as with the decrease in acid content and the increase of ratio of solids to acids; also with the end of the process of sugar elaboration and the beginning of inversion of sucrose.

Taking the changes enumerated and the signs of maturity above referred to as criteria to judge the maturity of the fruit, it may be assumed that grapefruit in this region may not be considered ripe and fit to eat before the ratio of solids to acids in solution in the juice has reached at least 7:1. This minimum ratio should be accompanied by the signs of maturity evident on inspection.

The changes enumerated above apply in a general sense to the three varieties tested, but the rate at which they proceed and the extent to which they take place differ for each variety.

Excessive rainfall causes delay in the process of maturation of grapefruit and increases the proportion of juice, but decreases that of solids and acids. The ratio of solids to acids is lower in rainy seasons than in seasons of moderate rainfall.

The influence of soil type on the composition and quality of the fruit is not very pronounced.

The chemical composition of the fruit does not greatly affect its quality, nor does the chemical composition of the soil greatly affect that of the fruit. Nitrogen is the only element of nutrition the amount of which in the fruit may depend on the amount present in the soil. However, the fertilizers used must be taken in consideration.

Sweating has little effect on its composition, the most noticeable change being produced in the color. The most important changes undergone by grapefruit in storage are loss in weight and inversion of sucrose.

Variations and fertility of the hybrid *Primula variabilis* compared with those of the parents, L. BLARINGHEM (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 16, pp. 992-994).—*P. variabilis* is a spontaneous hybrid capable of limited self-perpetuation through seeds, though characterized by the remarkable abundance and duration of its inflorescence. One of the parents, *P. officinalis*, is said to be a clearly defined species, very stable physiologically. The other, *P. vulgaris*, is said to be very unstable, the pollen being largely aborted or variable in size. This irregularity is probably not independent of the morphological variations which have led some to consider *P. variabilis* as a subspecies of *P. vulgaris*.

FIELD CROPS.

[Report of field crops work in Hawaii, 1921], H. L. CHUNG and F. G. KRAUSS (*Hawaii Sta. Rpt. 1921*, pp. 26-32, 60-62, pls. 2, fig. 1).—The continuation of earlier experiments (E. S. R., 46, p. 633) is described.

In cooperative sweet potato variety tests near the ocean, potatoes that grew nearest the shore had a slightly higher salt content than those in other parts of the field. All tests with the Hamakua Hybrid Irish potato, a variety originating on the island of Hawaii, indicate that a fair crop of marketable tubers can be produced from stocks obtained from the place of origin, even without spraying. Succeeding generations of this variety grown on the island of Oahu do not seem to retain the blight-resistant character. Corn investigations included breeding and selection work and trials of exotics. Cuban Red X Guam corn surpassed the parent varieties in yields of green fodder. Notes are given on cassava, edible canna, taro, Napier and Merker grasses, Uba cane, alfalfa, cowpea varieties, kulthi bean (*Dolichos biflorus*), mungo bean, *Lupinus albus*, and yam bean. Kudzu plants from cuttings bore one or more

enlarged roots, while plants from seeds had elongated fleshy roots only, although the foliage growth was about equal.

Klein Wanzleben sugar beets produced about 14 tons of roots with over 4,900 lbs. of calculated sugar per acre at the Haiku (Maui) Substation. Michigan and Idaho strains followed closely in yields of roots and sugar but only produced one-half the weight of green tops. The acre yields of green forage about 100 days after planting amounted to about 20 tons per acre with Yellow-Tip cane, 17 tons with Uba cane, 15.5 tons with Napier grass, and 10 tons with Merker grass. Merker and Napier grasses are ready for cutting long before either Uba or Yellow-Tip canes are mature, and make much better growth during the dry weather. Napier grass is much more succulent throughout its development than Merker grass and is considered the better. Plats of edible canna with 250 lbs. of phosphatic fertilizers per acre in the furrow at planting yielded twice as much forage and tubers as unfertilized plats.

Wiebke cassava continued outstanding as to quality and yield. New Era Yellow Flint corn in storage showed comparatively little injury from weevil, while three dent varieties were extensively eaten after a 4-month period of serious infestation. Seven varieties of pop corn were compared as to yield.

[Report of field crops work at the Crookston, Minn., Substation, 1921], C. G. SELVIG (*Minnesota Sta., Crookston Substa. Rpt. 1921, pp. 12-26, 51, 52, 61-63, 65-72*).—Experiments reported in continuation of earlier work (E. S. R., 47, p. 331) included seeding tests with spring and winter wheat, oats, barley, rye, flax, and potatoes; varietal trials with spring and winter wheat, oats, barley, rye, corn, soy beans, alfalfa, flax, potatoes, mangels, rutabagas, turnips, and sugar beets; fertilizer tests and studies of tuber unit selections with potatoes; and crop rotation experiments.

The yields of wheat in the 3-, 5-, and 7-year rotations were about equal, slightly favoring the short rotation. Wheat continuously, alone, and with 6 lbs. of clover, decreased in yield, partly due to wild oats in the plats. Oats yields continued in favor of the 7-year rotation.

Results from fertilizer trials with potatoes do not indicate increased yields from the use of potash. Potash-nitrogen and potash-phosphate combinations gave the highest average returns. Potatoes responded less to both rock and acid phosphate with manure than when the minerals were used alone. Acid phosphate was the only one of the three materials to show profit, and was of benefit to succeeding grain crops. Acre applications of from 4 to 32 tons of manure affected the yield of potatoes but little. Heavy applications of manure were evidently not beneficial in dry years.

It was observed that although the yield may not necessarily be decreased, tuber diseases can not apparently be controlled effectively in a 3-year period, as the organisms seem to survive the rotation cycle. The gross feeding habits of the sunflower rendered it unsuitable as a crop with potatoes in a short rotation. Continued cropping of the land in 4-year rotations without manure, fertilizer, or legume had a tendency to lower yields.

[Report of field crops work at the Duluth Substation, 1921], M. J. THOMPSON (*Minnesota Sta., Duluth Substa. Rpt. 1921, pp. 5-16, 20-23, figs 5*).—The continuation of earlier work (E. S. R., 47, p. 129) is reported with brief notes on varietal trials with spring wheat, oats, rye, barley, beans, millets, potatoes, and legume forage crops.

Spring wheat culture is not recommended in the northeastern counties, as the crop hardly conforms to the system of agriculture and is often damaged by rust and scab. The heaving of the heavy clay soil has rendered the growing of winter wheat rather uncertain. With proper soil conditions, millets

may be grown successfully in northeast Minnesota but should be used primarily as an emergency or annual forage crop and with limited acreage.

A progressive decline in yield was noted with the later dates of seeding winter rye. The slight increases secured hardly justified rates of more than 70 to 84 lbs. per acre.

Sunflowers in 30-in. rows yielded slightly more and better silage than in wider spacings. Plantings made May 18 and June 1 and 15 gave 19.4, 16.8, and 16 tons per acre, respectively. In a dry season, sunflowers on spring plowing produced about 2 tons less than on fall plowing.

Seed potatoes treated with corrosive sublimate produced 3-year acre average yields of 262 bu., with formalin 270 bu., with copper sulphate 229 bu., and with untreated seed 282 bu. However, the untreated seed was in each case produced from treated seed of the year before, planted on clean land. Potatoes given ridged and level culture averaged about equal. Checked rows made 246 bu. per acre, and drilled rows with twice the number of hills 210 bu. Rows 30 in. apart outyielded both 36- and 42-in. rows.

Barley and clover-timothy hay showed a progressive decline in yield from the 3- to the 5-year rotations. The progress of clover utilization experiments and of rotations without clover or manure gave results similar to those noted previously (E. S. R., 47, p. 121).

[Report of field crops work at the Morris, Minn., Substation, 1921], F. E. MILLER (*Minnesota Sta., Morris Substa. Rpt. 1921, pp. 21-39*).—The progress of experiments with various field crops is reported as heretofore (E. S. R., 47, p. 130). Among the leading varieties were Improved Manchuria barley; Marquis, Preston, and Mindum spring wheat, and Turkey winter wheat; Iowar and Sixty-Day oats; Robust and Great Northern field beans; Soysota soy beans; Grimm, Baltic and Turkestan alfalfa; Rustler White Dent and Minnesota 13 corn; Minnesota No. 2 rye; and Early Ohio and Rural New Yorker potatoes. Rate and date of seeding trials with winter wheat and rye are also noted.

In a 4-year rotation of corn, wheat, barley, and red clover, where the two cuttings of clover were used for hay, pasture, or green manure, or in combination, the grain yields were very much alike with all treatments. The use of any part of the clover crop for green manuring on the average silt loam soil of the district is apparently without advantage. Six years' results indicate that alfalfa can be used profitably in a rotation including 4 years of alfalfa and 4 years of corn and grain, that corn gives good results following alfalfa, but that the small grains can be grown best after a cultivated crop. Both corn and barley responded to the application of phosphate in this test, but not to potassium sulphate.

Potatoes sprayed with Bordeaux for early blight again outyielded unsprayed plants. Plantings 3 in. deep averaged 119 bu. per acre for 3 years, outyielding 2-, 4-, and 5-in. plantings which ranked in the order given. Level cultivation is apparently preferable to ridging, especially in a dry season.

[Report of field crops work in the Virgin Islands, 1921], L. SMITH (*Virgin Islands Sta. Rpt. 1921, pp. 3-5, 7-10, pl. 1*).—The experimental work reported continues that described heretofore (E. S. R., 45, p. 126).

S. C. 12/4 sugar cane continued to make higher acre yields of cane than the standard variety Ribbon, and with an average increase in sugar per acre of about 50 per cent. Extensive planting of both S. C. 12/4 and S. C. 12/37 is urged. It is noted that so far the seedling canes raised on the islands have succeeded better than introduced canes.

The ravages of the pink bollworm (*Pectinophora gossypiella*), together with the great drop in prices, are said to have considerably lessened the interest in growing Sea Island cotton at St. Croix. Observations of the results of plant-

ing on new land confirm previous findings that cotton planted on land that has produced two or more cotton crops will give just as good, if not better, crops than cotton planted on new land, especially if shallow plowing is practiced and no fertilizer is used. Suggestions are given for the control of the pink boll-worm. A detailed account of the Sea Island cotton industry in St. Croix has been noted (E. S. R., 45, p. 232).

In further trials with velvet beans and jack beans for green manuring purposes, excellent results were had with a mottled seeded velvet bean obtained from Porto Rico. The Lyon bean gave the best results of the green manure crops tried. Its analysis shows 0.99 per cent of nitrogen in the green vine and 0.48 per cent in the root.

Napier grass was found worthy of extensive planting because of its drought resistance and large yields. Guatemala grass continued to give good results, 40 tons of fodder per acre being obtained at one cutting from a plat with about 6 months' growth.

Experiments with cotton and peanuts and crops grown in rotation with them in Nansemond County, E. T. BATTEN (*Virginia Sta. Bul.* 229 (1922), pp. 22, figs. 6).—The results of experiments with cotton and peanuts and crops in rotation with them at the Nansemond County Substation are summarized.

Fertilizer tests with cotton indicated for general use from 300 to 600 lbs per acre of 4-8-4 fertilizer, with the nitrogen reduced on soils adequately supplied with this element. Lime was not beneficial except when used with nitrogen and potassium, and even then the increase was barely profitable. Trice is the outstanding variety, with Columbia and Durango indicated as the best long staples.

Examples are given of desirable rotations with peanuts. Direct applications of fertilizer are not advised for peanuts on soils of ordinary fertility, but on poor soils acid phosphate with some organic source of nitrogen, such as cottonseed meal, is indicated for good results. Lime improved the quality of the nuts rather than the quantity. Virginia Runner is apparently the heaviest yielder but does not sell as well as Virginia Bunch or Jumbo.

Although 1-ear corn varieties yielded highest, their tendency to rot in wet seasons makes the hard grain sorts most popular in the section. Up to 600 lbs. per acre of a 4-8-2 fertilizer is desirable with corn. Top-dressings of nitrogenous salts may be applied with profit at the last cultivation. One ton of burnt lime or its equivalent in ground limestone per acre seems to be enough to use in the corn rotation.

Soy beans planted in the same row with corn have not affected corn yields and provide good grazing for hogs. Black Eyebrow was the earliest variety tested; Wilson, Ito San, Haberlandt, and Virginia were among the best of the intermediates; and Mammoth Brown and Mammoth Yellow were the best late varieties.

Other crops found of value were Abruzzi rye, crimson clover, and grass hay.

Trials of new varieties of cereals, E. S. BEAVEN (*Jour. Min. Agr. [London]*, 29 (1922), Nos. 4, pp. 337-347; 5, pp. 436-444, figs. 2).—The methodology of varietal trials with cereals is considered, and an account is given of methods employed by the author to secure comparative accuracy.

In the half-drill strip method, the new race and a control are grown on 10 or more alternating strips of about $\frac{1}{2}$ acre each, and of the width of the drill employed. One-half of the seed box is filled with control seed and the other with seed of the new race, so that with each turn of the drill 2 half-drill strips of the same race are seeded alongside, making in 21 turns 10 drill-wide strips of each race, and a half-drill strip which is excluded at the end of each series. With 2 controls 2 acres are required, as the experiment is duplicated

in every respect. To eliminate error due to interference, one row of each race is cut out along the lines of separation before harvest. By adjusting the binder it is said to be possible to harvest $\frac{1}{10}$ -acre sections with about 2 sheaves each, and a close approximation to the probable error of the total weights of grain and straw on 0.5 acre of each race can be obtained by statistical treatment of the sheaf weights. The probable error of the weight of grain was found less than that of the corresponding weights of grain plus straw. Results indicate that by the half-drill strip method the probable error of the difference between the weights of grain of the two races may be reduced to about 0.5 per cent, as compared with more than 5 per cent with single plats.

Rye-wheat and wheat-rye hybrids, E. F. GAINES and F. J. STEVENSON (*Jour. Heredity*, 13 (1922), No. 2, pp. 81-90, figs. 4).—Rosen rye was crossed with Jenkin, Hybrid 128, and Jones Fife wheat at the Washington Experiment Station, and F_1 plants were obtained which were not entirely sterile even when Rosen was the female parent. The F_2 from these crosses strongly resembled Rosen, and a few exhibited a degree of fertility equally as high. One wheat-rye cross was obtained with Turkey wheat \times Rosen rye. While Rosen pollen did not stamp the rye characteristics on the F_1 or F_2 progeny to any great extent the abnormality and barrenness of the plants showed a violent upsetting of normal metabolism. In every case cited only matroclinous hybrids were obtained. Although Turkey is very resistant to bunt, a completely bunted plant occurred in the F_2 generation of Turkey \times Rosen.

Growing grain in rows, M. CHAMPLIN (*West. Canad. Soc. Agron. Proc.*, 2 (1921), pp. 7-11).—Information is presented concerning growing small grains in cultivated rows as a partial substitute for fallow, together with the results of cooperative trials and preliminary experiments by the University Saskatchewan. The results obtained encouraged further investigation. Experiments in South Dakota with Sudan grass and barley in cultivated rows have been noted (E. S. R., 38, p. 341; 41, p. 435).

Hill fertilization of corn, C. E. MILLAR (*Michigan Sta. Quart. Bul.*, 5 (1922), No. 2, pp. 69-73, figs. 8).—No striking variation in the root development of corn plants was observed where 3-10-4 commercial fertilizer was either applied near the seed at the rate of 200 lbs. per acre or 400 lbs. per acre was broadcasted. When corn fertilized in the hill suffers more from drought than does unfertilized corn, the reason probably lies in a greater moisture requirement of the plants, due to a greater vegetative growth.

A new method of corn improvement by selection, H. F. ROBERTS (*Sci. Agr.*, 3 (1922), No. 2, pp. 37-50, figs. 3).—The author proposes three methods of corn breeding, embodying modifications of the methods advocated by G. H. Shull, by Williams (E. S. R., 18, p. 1039), and by Miller and Hughes (E. S. R., 23, p. 436). A list of 99 titles on the selection of corn is appended.

In the method advocated for experiment stations, ears are chosen from the general field for ear-row tests for a number of successive years, from which ears representing the highest yielding biotypes are finally taken, the seed mixed and sown in a multiplying plat, whence seed ears are sold to farmers.

The commercial system recommended is a modification of the Ohio system of Williams. A "pedigree-line plat," continued year after year, is composed of ear-rows seeded from weighed and scored ears, chosen from field selections from the best-yielding ear-rows of the previous season. After the second year the remnants from ears producing the best-yielding ear rows of the preceding season are mixed and seeded in the "stock-supply plat," which is also continuous. Ears field selected in this plat are added annually to the ear-row plat, while seed ears not field selected are chosen with the score card, mixed, and used in bulk to plant the multiplying plat. Field-selected ears from the

multiplying plat furnish seed to plant the general field. Seed for sale is taken first from multiplying plats and finally from the general field.

Ears are selected from the original field and grown ear-to-row in the out line suggested for farmers. Half the seed from ears taken from the best-yielding rows is planted in the general field, and half in the breeding block. Seed ears are chosen from the breeding block, half being mixed the following season to plant the general field, and half for the breeding block. By this method the ear-row plat is required in alternate years only.

Varieties of cotton in northwest Texas, R. E. KAPER (*Texas Sta. Bul.* 299 (1922), pp. 3-26, figs. 3).—The results of varietal experiments with cotton at the Lubbock Substation from 1912 to 1921 are tabulated, with a discussion of the relation of weather to cotton production. Cotton is considered a dependable crop on the plains within an area from 30 to 75 miles wide and 150 miles long following the cap rock. Earliness and storm resistance are the most desirable characters for this region.

Although Burnett cotton, the best yielder, lacks storm resistance and has a relatively short staple, it is profitable under extreme conditions on account of earliness. The Mebane cottons were consistent good yielders with fair storm resistance and staple, and under ordinary conditions are indicated for general planting. Toole, Cook, and Hawkins yielded considerably above the average in the years tested. Lone Star has valuable storm resistance and good lint quality and does well in favorable years, but its late maturity and tendency to produce an occasional crop of bolly cotton do not favor it as consistently profitable.

Among the extra staples, Acala, Durango, and Snowflake ranked in the order named as to yield and inversely as to staple. Comparison of the acre lint yield and the length of staple of the best varieties of each type or class shows a decided decrease in yield as the length of staple increases. The present premium for the better staple cottons is deemed insufficient to compensate for the lower yields.

The Pima cotton industry of Arizona (*Ariz. Indus. Cong. Bul.* 7 (1922), pp. 40).—This comprises addresses delivered at the Pima cotton conference in Phoenix in April, 1922.

Cotton growing in Nigeria, H. DUFF (*London: Empire Cotton Growing Com., 1921*, pp. 81+6, pl. 1, fig. 1).—Descriptions of the country, its natives, cotton centers, and systems of communication are given from an extensive survey. The major portion of the brochure comprises constructive criticism regarding the development of the cotton industry and transportation in the colony.

Regulations regarding cotton pests and diseases in British Colonies and India (*Bul. Imp. Inst.* [London], 20 (1922), No. 2, pp. 192-207).—Summarized statements are given of regulations in force in India and in the British Colonies in Africa, West Indies, and elsewhere.

Results of the examination of cotton from Tanganyika (*Bul. Imp. Inst.* [London], 20 (1922), No. 2, pp. 141-146).—Descriptions, strength, length, and value are given for 26 samples of cotton from several districts in Tanganyika.

Inheritance and yield with particular reference to rust resistance and panicle type in oats, R. J. GABER (*Minnesota Sta. Tech. Bul.* 7 (1922), pp. 5-62, pls. 6).—Minota and Victory, open-panicked pure lines of oats susceptible to stem rust, were crossed with a side-panicked pure line of White Russian oats, relatively resistant to stem rust, and the inheritance of host reaction to rust, panicle type, and pollen abortion was studied in the F_1 , F_2 , and F_3 generations. The correlation between rust reaction and yield and between panicle type and yield was also observed.

The conclusion that the rust resistance of White Russian is not due to relative size of stomata was corroborated by the relative width of the stomatal openings when at a maximum in the seedlings of this variety and of Victory. The data from F_2 and F_3 in both Minota \times White Russian and Victory \times White Russian evidenced that rust resistance is inherited as a dominant character depending on a single factor difference for its expression. In these crosses panicle type is apparently dependent on a single main factor for its expression. The F_1 plants were open-panicled but not to the same extent as the open-panicled parents.

The F_2 segregation and the frequency with which side-panicled susceptible and open-panicled resistant F_2 families were obtained indicate that rust reaction and panicle type are not closely linked in inheritance.

Victory, Minota, and White Russian produced averages of 12.4, 1, and 0.9 per cent, respectively, of aborted pollen. The F_2 segregation of White Russian \times Victory indicated that aborted pollen as found in Victory was inherited as a recessive character involving at least two factors. No evidence of a close association in inheritance between panicle type and pollen abortion appeared.

The approximate average reductions of yield in the F_2 , because of rust in Minota \times White Russian and Victory \times White Russian, were 12 and 37 per cent, respectively, among the open-panicled forms, and 34 and 24 per cent among the side-panicled forms. In the F_3 the average percentage reductions of yield were 24, 14, and 37, 30 in the 2 crosses, respectively. Although no consistent correlation between panicle type and yield was found, wherever a significant difference appeared the open-panicled forms gave the greater average yields.

Varieties of potatoes for Nebraska. H. O. WERNER (*Nebraska Sta. Bul.* 182 (1922), pp. 39, figs. 18).—Variety trials with potatoes at 12 points, principally in the western part of the State, are reported with notes on the climate and soil as factors in potato production. The best seed-potato areas of Nebraska are at an altitude of 4,000 ft. or above, where the temperature from June 1 to September 30 averages below 67° F. The chief commercial potato-growing areas of the State are the high altitude dry-land and irrigated regions in the northwestern part, the river valleys of the central and eastern part, and the north-central area.

The great differences in yield and quality of tubers noted between different lots of the same variety in the comparative trials were largely due to the climatic and soil conditions under which the several lots were produced, as well as to the prevalence of disease and difference in seed selection. With proper seed selection very good seed potatoes can be produced in the dry-land areas of western Nebraska. The merits of dry-land and irrigated seed have been compared elsewhere (E. S. R., 47, p. 735). While irrigation increases the number of potatoes per plant, the enhanced yield resulting from irrigation is mostly due to enlarged size of tubers.

On dry land, the fewest tubers per plant, with greatest weight per tuber, were produced by Early Ohio and Pearl, and the most tubers per plant by Downing. Under irrigation, the most tubers per plant were produced by Downing and King, and the least number by Early Ohio; and the largest tubers by King and Early Ohio, and the smallest by Downing.

Variety recommendations based on experimental results and general observations are as follows: Northwestern high-altitude regions, dry-land culture, for table and seed, Triumph, Early Ohio, and Irish Cobbler; irrigation, heavy, level, and fertile soils, Triumph, Downing, Rural New Yorker, and King; irrigation, fine sandy soils or soils of low moisture capacity, Irish Cobbler, Rural New Yorker, and Triumph; and central and eastern Nebraska, early Ohio and Irish Cobbler.

[**Potato experiments in New Jersey**], G. W. MUSGRAVE and W. H. MARTIN (*New Jersey Stas. Rpt. 1921*, pp. 263-269, 453-460, pl. 1).—According to Musgrave, potatoes on alfalfa sod receiving phosphorus have given higher yields than with other treatments. On a very good soil enhanced yields were secured from an increase in size of seed up to and including 1.5 oz., and on a poor soil up to 2.5 oz. A smaller size of seed piece of late-crop seed gave results equivalent to the larger size of the mature northern-grown seed. Irish Cobbler yielded highest among the varieties. Selection work with strains is described briefly.

Martin observed that potatoes receiving fertilizer alone and with 100, 300, and 500 lbs. of sulphur per acre yielded 286, 289, 267, and 214 bu., respectively. From planting in the greenhouse December 2 to digging May 4, the pH values of the soils of the plats increased 0.1 and decreased 0.3, 0.7, and 0.83, respectively. Apparently a fertilizer mixture containing 100 lbs. of sulphur can be used without injury. Broadcasting 200 and 400 lbs. of sulphur produced no injury, whereas a plat receiving 600 lbs. gave 6.5 bu. less than the check. Decreases in pH concentration amounted to 0.02 with the check, 0.05 with 200 lbs. of sulphur, 0.27 with 400 lbs., and 0.6 with 600 lbs.

Irish Cobblers dug by Martin 2 weeks after blooming produced 125 bu.; with the plants green and vigorous, 157 bu.; 24 per cent of the leaves dead, 207 bu.; 50 per cent of the leaves dead, 258 bu.; 92 per cent of the leaves dead and the stems green, 281 bu.; and the leaves and stems dead, 281 bu. When these lots were used as seed, resulting acre yields amounted to 271, 260, 250, 243, 216, and 196 bu., respectively, with 82, 80, 77, 78, 77, and 78 per cent of prime tubers. Excepting the third lot, a fairly uniform decrease in the height of plants took place with increased maturity of the seed piece.

Potatoes, with a chapter on the artichoke, E. BECKETT (*London: Country Life; New York: Charles Scribner's Sons, 1922*, pp. 31).—A practical handbook for the British potato grower.

Rye breeding through self-fertilization, F. A. SPRAGG (*Michigan Sta. Quart. Bul.*, 5 (1922), No. 2, pp. 84, 85, fig. 1).—Self-fertilization of rye by hooding the heads with paraffined paper envelopes and by shielding the plant with cheese cloth upheld by 6-ft. stakes was successful. Cloth hoods proved too heavy for the culm, and when supported by stakes the growth was so great as to break over the stems.

The breeding of Göttinger rye, TORNAU (*Jour. Landw.*, 70 (1922), No. 2-3, pp. 171-190).—Examination of agronomic data from the last 20 years of rye inbred for 30 years showed the breeding relations of the strains, and demonstrated the difficulty of proving by cross-pollination the outcome of long continued breeding work. The risks from inbreeding with rye as a consequence of vast homozygosity should not be overrated, as the Göttinger strains were not affected detrimentally in spite of long continued inbreeding.

The influence of lime on the yield and nitrogen content of soy beans, season 1920, J. G. LIPMAN and A. W. BLAIR (*New Jersey Stas. Rpt. 1921*, pp. 321, 322).—In further studies (E. S. R., 46, p. 534), the yields on the unlimed plats continued to decrease, the average being less than 1 bu. of seed per acre. The highest acre yield of nitrogen from a limed plat was 89.9 lbs. and from an unlimed plat only 9.96 lbs. The highest yield of beans of the 11 varieties grown on limed plats only was 17.7 bu. per acre by Manchu, and of 6 varieties grown on both limed and unlimed plats 17.8 bu. with Edna, followed by 17.6 bu. with Baird and 17.5 with Wilson.

Report of the department of seed analysis, J. G. FISKE (*New Jersey Stas. Rpt. 1921*, pp. 167-172).—The average purity and germination are tabulated for 1,338 samples of agricultural seed and the results of tests of 32 samples of

legume inoculants during the year ended June 30, 1921. A list of weeds identified is included.

[Report of Canadian Seed Growers' Association, 1920-1922] (*Canad. Seed Growers' Assoc. Rpt.*, 17-18 (1920-1922), pp. 57, fig. 1).—The annual meeting held at Macdonald College, P. Q., is reported, together with reviews of the activities of the association and its branches during the period of March, 1920, to March, 1922.

Seeds regulations, 1922 (*Jour. Min. Agr.* [London], 29 (1922), No. 7, p. 667).—With certain exceptions, the regulations governing the trade in agricultural seed in Great Britain are practically identical with those noted earlier (*E. S. R.*, 45, p. 833).

The leafy spurge becoming a pest, N. L. BRITTON (*Jour. N. Y. Bot. Gard.*, 22 (1921), No. 256, pp. 73-75, fig. 1).—The dissemination of leafy spurge (*Tithymalus esula*, *Euphorbia esula*) since its collection at Newbury, Mass., by W. Oakes in 1827, is recounted and its eradication urged.

HORTICULTURE.

Report of the horticultural division [Hawaii Experiment Station], W. T. PORE (*Hawaii Sta. Rpt. 1921*, pp. 8-11, 12-23, pls. 5).—In continuation of the work of previous years (*E. S. R.*, 46, p. 640), various horticultural plants were studied in reference to their adaptability to the islands.

Because of its high value as a food plant, special attention was paid to the avocado, several varieties of which were received during the year from the U. S. D. A. Bureau of Plant Industry. Environmental conditions at the central station being somewhat unfavorable to the avocado, tests were also conducted at the Tantalus Substation, where climate and soils are more satisfactory. The Taylor avocado (station No. 4639), a seedling native to the islands, is deemed of great promise.

A survey of the banana-growing industry of the islands showed approximately 262 acres of bananas under cultivation, which on the basis of 800 plants per acre and one bunch per tree per year constitutes a commercial production of approximately 200,000 bunches.

Tests with numerous other fruits, including the papaya, mango, orange, lemon, grape, Macadamia nut, coconut, breadfruit, annonas, and litchi, are discussed.

[Report on horticultural investigations at the Crookston, Minn., Substation], C. G. SELVIG (*Minnesota Sta., Crookston Substa. Rpt. 1921*, pp. 52-60).—In conformation with the reports of earlier years (*E. S. R.*, 47, p. 338), the results of varietal tests with fruits and vegetables are briefly reported.

Certain fruits such as the crab apple, native plum, currant, and gooseberry again demonstrated their ability to endure the cold winters. Practically all kinds of vegetables, including sweet corn, tomatoes, and beans, produced satisfactory yields in 1921; however, the drought obtaining in May and June was somewhat unfavorable to crops such as onions, peas, and cabbages which normally require a cool, moist environment.

The various species of trees, including green ash, white elm, golden willow, arbor vitae, and jack, Norway, and Scotch pines planted in the spring of 1921 in solid blocks to determine their value as windbreaks, suffered from the severe drought obtaining in May and June.

Report of the department of horticulture, A. J. FARLEY, C. H. CONNORS, R. P. ARMSTRONG, and L. G. SCHERMERHOEN (*New Jersey Stas. Rpt. 1921*, pp. 71-99, pls. 4).—In this progress report (*E. S. R.*, 46, p. 536) of activities during the annual period ended June 30, 1921, considerable attention is devoted to the

effect upon various fruits of severe freezes which occurred during the blossoming period of 1921. Abnormal temperatures occurring during March and reaching a maximum of 82° on March 28 caused an unusual growth renewal on all kinds of plants, certain plums and shrubs being in bloom on the day mentioned. As a result of a drop to 24° on the night of March 28, material injury was caused to all types of plants, but, contrary to general expectation, injury was not correlated with the stage of development. Red June, Burbank, and Abundance plums, showing considerable bloom, suffered less injury than did certain apples whose flower buds showed no color. Numerous varietal peculiarities were observed in degree of resistance to freezes, and in the case of certain varieties of apples, axillary buds occurring on one-year wood were uninjured and contributed a partial crop of fruit. Those fruit buds in which the essential organs were killed ceased growth immediately, turned yellow, and either dropped or dried up. The behavior of numerous varieties of apples, peaches, and pears are given in tabular form, and the stage of bud development at the time of the freeze is illustrated for certain varieties. The degree of injury to a given variety depended upon several factors—age, location, and general condition of the tree. Tabulated blooming data are given for numerous varieties of peaches, apples, pears, plums, and ornamentals.

Progress in peach breeding studies was seriously hindered by the adverse weather conditions discussed above. Lists are given of peach seedlings in the nursery and of varieties and related species in the station orchards available as breeding material.

In winter pruning studies with the apple, the largest yields of fruit in 1920 were obtained from trees which had not been pruned from the time of planting. However, in general, the fruit from these trees was inferior to that from pruned trees. Except in the case of Stayman Winesap, thinning alone resulted in a larger crop than when accompanied by cutting back of the shoots. Fruit of the cut-back trees was borne largely on the interior twigs and, in consequence, was inferior in color to that of the thinned trees, which bore considerable of their fruits on the outer shoots. Furthermore, cutting back forced an unusual development of shoots on the one-year wood, resulting in a thickening of the outer part of the tree with consequent shading of the interior. Measurements of the 1919 shoot growth of trees on the various plats showed in every instance that the thinned and cut back trees have greatly exceeded the others in respect to total twig growth. Variations in height of trees of a single variety subjected to different pruning treatments were insignificant. In general the unpruned trees were of poor shape and consisted of a dense mass of interlocking and twisted branches which, in addition to excluding light, rendered spraying and harvesting operations very difficult. In contrast, the pruned trees were of good shape and easily managed. Of the two pruning treatments, thinning alone has been more satisfactory both in respect to color and yield of fruit and in requiring less time for pruning.

In tomato fertility tests at Masonville, Bonny Best plants produced with care at the station proved much more satisfactory, both in respect to number of living individuals and in yield of fruits, than did locally purchased seedlings. The largest average yield, 10.9 tons per acre, was produced on plats set with station plants and receiving 1,000 lbs. of a home mixed 4-8-6 material. The highest check average was 9.1 tons. A similar test at Cedarville with the Greater Baltimore tomato showed the highest average yield, 8.97 tons, on plats receiving 1,000 lbs. of a 4-8-2 home mixture. In this case the highest check average was 8.6 tons. Much better yields were obtained in experiments on the station grounds at New Brunswick, where with carefully grown plants of a selected strain of Bonny Best a maximum average yield of 15.18 tons was recorded

on plats receiving 1,000 lbs. of a 2-8-6 mixture. The highest check plats averaged 10.77 tons.

A test with Copenhagen cabbage grown on soil used for tomato fertility experiments in 1918 resulted in a maximum yield of 18.84 tons per acre on those areas fertilized with 800 lbs. of acid phosphate, 200 lbs. of potassium muriate, and 100 lbs. of nitrate of soda. The highest check plat produced 16.46 tons, and plats receiving 600, 800, and 1,000 lbs. of acid phosphate yielded respective tonnages of 16.7, 17.11, and 16.7.

Carnation breeding studies are briefly discussed.

[**Horticultural investigations in the Virgin Islands, 1921**], L. SMITH (*Virgin Islands Sta. Rpt. 1921, pp. 5-7, pls. 2*).—In addition to vegetables native to the Tropical Zone, it was found that corn, tomatoes, carrots, sweet peppers, eggplants, beans, radishes, kohlrabi, parsley, pumpkin, and certain varieties of string beans, now grown largely in the Temperate Zone, could be successfully produced. The tomato varieties Stone and Ponderosa were exceptionally satisfactory. Of the unsuccessful vegetables, including beets, sweet corn, cabbage, cucumbers, melons, and squashes, cabbage was unable to endure the dry weather, and the cucurbits and beets were attacked by devastating insects.

The star apple (*Chrysophyllum cainito*), fruiting for the first time, produced fruit of an excellent quality. The papaya, a species producing delicious and nutritious fruits and recommended for general planting in the islands, is, unfortunately, susceptible to various pests, insects, fungi, and nematodes. Wind-breaks are deemed to be essential for the protection of fruit trees, especially while immature.

A study of the relation of various fertilizer mixtures to the growth of celery in muck soils, R. F. POOLE and G. W. FANT (*New Jersey Sta. Rpt. 1921, pp. 336, 337*).—Pot experiments with celery (Golden Self-Blanching) grown in muck soil treated with 21 different fertilizer combinations led to the practical deduction that soil of the type used in the investigation may be improved for celery culture by applying mixtures low in ammonia, high in phosphoric acid, and comparatively low in potassium. Ammonium sulphate and sodium nitrate, mixed half and half, were used as source of nitrogen. Phosphoric acid was obtained from acid phosphate and potassium from muriate of potash. The fertilizers, applied at the rate of 1,600 lbs. per acre of 2,000,000 lbs. of soil, were thoroughly mixed with the soil when in an air-dry condition. Distilled water was added to produce a moisture content approximating 50 per cent of the water-holding capacity of the soil. Three celery plants were placed in each pot containing 5 lbs. (dry weight) of soil.

From the beginning those cultures receiving large quantities of phosphoric acid were stimulated in growth. The maximum dry weight yield, 46 per cent above the average of the checks, was obtained from the 2-10-4 mixture, the constituents being ammonia, phosphoric acid, and potassium, respectively. The 4-6-6 mixture gave the next highest yield, 37 per cent above the checks, and two others, 2-12-2 and 2-6-8, were approximately 20 per cent above the checks. Applications of large amounts of ammonia were apparently deleterious, some of the cultures abundantly supplied with nitrogen falling below the checks. Other cultures high in potassium and low in ammonia and phosphoric acid also gave low yields.

Comparison of first generation tomato crosses and their parents, R. WELLINGTON (*Minnesota Sta. Tech. Bul. 6 (1922), pp. 5-27, figs. 8*).—Investigations conducted at the University of Minnesota over a period of years, 1909-1919, indicated that first generation tomato crosses often surpass their parents in respect to yield, production of early fruits, and in symmetry of fruits. The

present paper is devoted largely to the work of the years 1914-1919, the earlier efforts being chiefly of a preliminary nature but indicating in a general way the superior merit of the F_1 cross.

From 1914 to 1919 60 F_1 generation tomato crosses representing 14 different varietal combinations were carefully studied and compared with their respective parents. In 21 instances the crosses produced a greater number of ripe fruits per plant than did their higher-yielding parent. In respect to total number of fruits, ripe and green, per plant, the crosses surpassed the mean of their parents in 17 of 24 instances in 1915, while in 1916, 1917, 1918, and 1919, the proportions were 7:7, 6:9, 4:4, and 2:3, respectively. When compared with the higher parent the gain in number of fruits was less consistent; nevertheless, over one-half the crosses produced more fruit than did the higher parent. The increase in number was correlated with a decrease in size of individual ripe fruits. A graphical illustration of the production of F_1 crosses as compared with the computed mean of their two parents and of their higher parent shows decidedly that the most conspicuous gains were in those crosses in which Earliana or its close relative, June Pink, occurred as one parent.

In dividing the harvest season into early, midseason, and late, there was found a distinct tendency for crosses to mature their fruit earlier than did their parents. During the five years 1915-1919, 33 crosses gave an increase and 9 a decrease in early fruit as compared with the mean of their parents. When compared with the higher parent, 24 crosses showed an increase and 22 a decrease in yield in the early part of the season.

Invariably the F_1 crosses between coarse types such as Earliana and June Pink and symmetrical types such as Bonny Best and Chalk Early Jewel yielded a larger percentage of smooth fruit than did the coarse type parent. The author believes that the surface depends upon numerous factors and is transmitted as an intermediate character. No simple splitting of the surface character was observed in the F_2 generation.

Yield of tomato varieties and crosses was found to be closely correlated with climatic conditions, fluctuating from year to year in accordance with variations in seasonal rainfall and temperature. Tomato strains responded differently to weather influences, the high and low yielding strains of the cold, wet season of 1915 reversing their positions in the following year. In 1916, a hot, dry season characterized by periodic rainfall, a definite tendency was recorded for fruit to increase in size for a short period after heavy rains.

The decumbent habit of plant growth in Earliana and June Pink was found to be dominant over the more vigorous and erect type found in Stone, Chalk Early Jewel, Bonny Best, etc.

In closing, the author points out the commercial possibilities of F_1 crosses, and recommends their consideration to greenhouse men and intensive growers operating on high priced land and to seedsmen specializing in high grade material. It is thought that the cost of producing F_1 seed would be more than offset by the increased yield of superior early fruits.

Experiments in soil management and fertilization of orchards, J. K. SHAW (*Massachusetts Sta. Bul.* 209 (1922), pp. 30-60, figs. 11).—This paper discusses the results of fertility experiments conducted in two apple orchards located about 6 miles apart in Amherst, Mass.

The older and original investigation, that carried on in a station orchard containing four varieties, Rhode Island Greening, Roxbury Russet, Baldwin, and Gravenstein, was begun in 1889 for the purpose of studying the comparative effect of five fertilizer treatments: (1) Manure, (2) ashes, (3) bone and muriate of potash, (4) bone and low grade sulphate of potash, and (5) nothing

The fertilizers were applied in uniform amounts for 26 consecutive years. The system of soil management, however, was varied and falls into four distinct periods, as follows: 1889-1893 various intercrops, 1894-1902 sod with hay removed, 1903-1910 sod mulch, and 1911-1920 strip cultivation. Circumference measurements taken at various times and illustrated graphically show the maximum growth gain in the manure plat, next in the bone and sulphate of potash plat, and least in the check area.

A study of varietal responses to fertilizers indicated differences between the Baldwin and the Roxbury Russet on the potash plats, but these differences could not be definitely ascribed to fertilizer treatments. Records of picked and dropped fruits recorded for the various areas and for the four varieties within each area showed the largest yield on the manure plat, with bone and sulphate of potash second, ashes third, bone and muriate of potash fourth, and the check fifth. The varieties, arranged in order of yield, were Rhode Island Greening, Baldwin, Roxbury Russet, and Gravenstein. The change from sod to strip cultivation in 1910 was clearly depicted in sharply increased yields on all plats the first two or three years following the transition. In respect to yield up to 1911, the sulphate of potash plat was notably superior to the muriate plat; since that date these plats have gradually converged. In general, a marked correlation was found between growth and yield, increased growth being followed by increased production. Differences were observed in the quality of fruits of the various plats, for example, those of the manure area were generally larger but lacked in the high color characterizing the sulphate of potash and ash areas.

The results obtained in the second and younger experiment, that conducted in a leased Baldwin orchard located some 6 miles distant from the station, confirmed in general those obtained in the older experiment. Trunk circumference recorded at intermittent intervals showed the least increase in growth on the unfertilized check area, thus indicating that there was some response to all fertilizer treatments. Manure and lime-carrying fertilizers were more beneficial than chemicals which carried no lime. However, the largest yield of fruit was obtained on that plat receiving bone, muriate, and magnesium. Contrary to results in the older experiment, no differences were found to indicate that low grade potassium sulphate is superior to the muriate. Trees located in a strip of sod at one end of the orchard made conspicuously less growth than those in the cultivated areas.

The original data upon which the discussion is based are appended in tabular form.

Care of defoliated cherry orchards, R. E. MARSHALL and W. C. DUTTON (*Michigan Sta. Quart. Bul.*, 5 (1922), No. 2, pp. 61-63, fig. 1).—With a view to promoting the restoration of vigor and profitable production in cherry orchards prematurely defoliated by leaf spot in the summer of 1922, suggestions are made relative to necessary pruning, cultivating, spraying, and fertilizing.

Pruning of small fruits, R. E. LOREE (*Michigan Sta. Quart. Bul.*, 5 (1922), No. 2, pp. 63-65).—Instructions are given relative to the pruning of raspberries, blackberries, dewberries, currants, and gooseberries.

Cranberry investigations, C. S. BECKWITH (*New Jersey Stat. Rpt.* 1921, pp. 389-408).—Similarly to that of the preceding year (*E. S. R.*, 46, p. 540), this report deals largely with fertility studies.

Second year results of nitrogen studies with the Early Black cranberry growing on Savannah soil indicated that 30 lbs. of nitrogen drawn from nitrate of soda is an excessive annual application, and that 20 lbs. is nearer the correct amount for a large crop. Nitrogen from dried blood did not give as satisfactory results as nitrogen from nitrate of soda, and no advantage was found

in combining the two forms of nitrogen. In a test of various quantities, 264, 528, 792, and 1,056 lbs. per acre, of a mixed fertilizer consisting of 75 lbs. of nitrate of soda, 75 lbs. of dried blood, 300 lbs. of acid phosphate, and 50 lbs. of potassium sulphate, the best results were obtained from the use of 792 lbs. The application of various quantities of acid phosphate to cranberries on a Savannah soil with an iron-ore bottom did not give any conclusive results. However no damage was noted from the use of amounts of acid phosphate ranging up to 300 lbs. per acre. Barium phosphate did not in itself show any beneficial results, but was improved when supplemented with 7 per cent of barium sulphid. Records of the yields of cranberry plats treated in 1919 with various amounts of calcium cyanamid showed a marked residual effect, more pronounced than the initial response. The gains were not, however, as definite as those obtained from the use of nitrate of soda. Observations in 1920 upon the yield of plats comprising a qualitative study of various plant foods for the cranberry on Savannah bottoms showed that nitrogen did not have as an enduring residual effect as phosphoric acid, especially in the form of rock phosphate. Potash forms, except kainit, were found very effective two years after the time of application. A similar test started in 1920 on a mud bottom indicated in a preliminary way that insufficient phosphoric acid is the limiting factor on bogs of this type.

In soil acidity investigations a difference between limed and unlimed areas was observed for the first time in 1920. On Savannah bottoms those plats limed in 1918 showed an increased yield over untreated areas, the greatest increase being found on that plat which received high-grade calcium limestone at the rate of 2 tons per acre. A series of plats receiving annual applications of limestone showed slight increases, the larger increases being present on the plats receiving small amounts of limestone. It is thought that the increased yields found on the limed areas may be due to the increased activity of nitrogen fixation bacteria favorably influenced by lime applications. The results indicated that three years are required for such an effect to take place on Savannah soils.

Flooding investigations conducted at Whitesbog in 1920 under the direction of J. W. Shive indicated that when the water is promptly removed following the flooding of small plats to a depth of 1 ft. (1) there is no apparent injury to vines, (2) maturation is retarded, (3) if flooded early in the season cloudy weather during the flooding period may cause the tips to die back, (4) the number of diseased berries increases, especially when flooded late in the season, and (5) some berries, probably less than 5 per cent, break loose from the vines. Flooding over a period of several days during the harvest season gave contradictory results, but indicated that this operation at this time is a dangerous practice and may result in a notable decrease in marketable berries.

Pineapple experiments [at the Haiku Substation, Hawaii], F. G. KRAUSS (*Hawaii Sta. Rpt. 1921, pp. 52-55, fig. 1*).—This is a summary of information on improved cultural practices based largely on the results of previously reported experiments (E. S. R., 46, p. 643).

The red and gray coarsely granulated and porous soils characteristic of a large part of Hawaii's pineapple area are especially well adapted to the crop. The finely textured black manganiferous soils abounding in the upland pineapple region of Oahu are described as very productive when plants are sprayed with iron sulphate solution. The most favorable elevation for pineapple growing was found to lie between 500 and 1,000 ft., though excellent fruit is produced up to 1,600 ft.

No single factor has proved so injurious to pineapple production as that of working soil while wet. Subsoiling was found very beneficial both before and

after planting. In lieu of high ridging, which has not proved satisfactory, subsoiling and middle busting with maintenance of gentle ridges are recommended. It is recommended that strong healthy stock, neither immature nor overripe, should be utilized for propagation. In midsummer, if the season is dry and the soil in good tilth, plants need not be as mature as when planted in cool, wet weather and may be set without preliminary curing. Overmature plants should be adequately stripped of their basal scales or leaves.

Stable manure is recommended as the best fertilizing material for improving poor soils. Pineapple cannery waste and green manures were of practically equal value, and chemicals, with the possible exception of ammonium sulphate, produced uncertain and variable results. In a test of nitrogenous fertilizers, none of the materials potassium nitrate, ammonium nitrate, ammonium phosphate, ammonium sulphate, sodium nitrate, and dried blood applied in single and fractional doses ranging between 200 and 400 lbs. per acre showed any marked beneficial effects on the pineapple. As a result of studies inaugurated to determine the value of turning under green manures and crop residues, it is recommended that as soon as the last harvest of any planting cycle is completed, the soil be thoroughly and deeply worked and planted to pigeon peas at the rate of 10 lbs. of seed per acre. The peas should be allowed to occupy the ground for a period equal to the preceding pineapple crop. Pods may be gathered for seed or the plants cut for hay. With the turning under of the peas the soil will be sufficiently restored to produce a profitable yield of pineapples.

FORESTRY.

[Forestry at the Michigan Station], P. A. HERRBERT and A. K. CHITTENDEN (*Michigan Sta. Quart. Bul.*, 5 (1922), No. 2, pp. 81-84).—Records obtained in a 45-year-old test planting, originally consisting of 150 species planted 4 ft. apart and never thinned, are believed to furnish excellent information relative to the adaptation of species to adverse conditions. The plot is nearly level, the soil chiefly sand, and the drainage good. The three leading species in respect to average diameter were the chestnut, black locust, and basswood, and of these the chestnut was very satisfactory both in growth and form. The black locust made the same diameter as the chestnut but was inferior in height and form and was also subject to injury by borers, and the basswood made a satisfactory growth. Common species, such as maple, white oak, hickory, and beech, made the slowest growth but were able to persist despite suppression. With the exception of the European larch and Norway spruce, nature eliminated practically all exotic species. Since practically all the reproduction consists of maple, beech, ash, birch, and ironwood, the present leaders would be naturally eliminated from the next stand, leading to the conclusion that it is necessary to plant desirable, fast-growing species in order to insure their presence in the ultimate forest.

In realization that the shortage of coal may cause increased cutting in the woodlot, timely suggestions are made relative to thinning so that the least possible permanent injury may be effected.

Effect of removal of the virgin white pine stand upon the physical factors of site, J. A. LARSEN (*Ecology*, 3 (1922), No. 4, pp. 302-305, figs. 2).—Meteorological records taken in the summer of 1919 at three different locations near the Priest River Forest Experiment Station, Idaho, indicated that the removal of the forests had a marked effect upon air and soil temperatures and moistures.

One station was established in the open, one in a one-third cover, and the third within the uncut virgin forest, consisting of 300-year-old western white

pine. Records taken from July 12 to August 31 and presented for the most part in tabular form show that the air in the uncut forest was about 10° warmer at night and 10° cooler in the heat of the day. In the clear cut area the soil temperatures fluctuated from 4 to 5° and in the forest varied only 1°. The rate of evaporation in the open was more than twice that within the forest, and in the partly cut area was intermediate between the other two sites. The lower soil moisture found under the virgin timber is explained by the high transpiration rate of the large trees and the interception of rain fall on the part of their crowns. The complete opening of the site practically prevented the establishment of hemlock, cedar, and white pine. Many of the evergreen plants naturally present as undergrowth disappear completely in the clearing, and are succeeded by various shrubs and grasses which become so dense as to prevent the reestablishment of the forest.

The silvicultural treatment of the more important timber-producing eucalypts, G. E. BROCKWAY (*Empire Forestry* [London], 1 (1922), Mar., pp. 52-65; No. 2, pp. 229-246).—A general article discussing soil relations, seed collection, nursery practices, silvicultural systems, methods of regeneration, rate of growth, and necessary protective measures.

Tropical trees with light-weight wood, W. W. ROWLEE (*Jour. N. Y. Bot Gard.*, 22 (1921), No. 256, pp. 75-78).—Three genera, *Ochroma* and *Cavanillesia* of the Bombacaceae and *Jacaratia* of the Caricaceae family, supplying exceptionally light-weight woods, are discussed in this paper in relation to their source and botanical and structural characters. Timbers of this type are found principally in the tropical rain forest region and chiefly in the belt of equatorial calms. The trees are characterized by an extensive leaf area, the bark is usually thick and fibrous, and the wood is white or very light in color. It is noted as a remarkable fact that these extremely light woods are, locally, often immediately associated with very heavy types.

Annual report of the director of forestry of the Philippine Islands for the fiscal year ended December 31, 1921, A. F. FISCHER (*Philippine Bur. Forestry, Ann. Rpt. Dir. Forestry, 1921*, pp. 103).—Of a similar nature to that of the preceding year (E. S. R., 46, p. 645), this report reviews the activities of various divisions of the Bureau of Forestry and presents miscellaneous statistical data relative to forest products revenues, and expenditures.

Annual return of statistics relating to forest administration in British India for the year 1920-21 (*Brit. India Forest Admin. Statis., 1920-21*, pp. 29, pl. 1).—This is the customary report relative to alterations in area, revenues, expenditures, etc. (E. S. R., 46, p. 238).

DISEASES OF PLANTS.

Some recent changes in the names of plant diseases, G. H. CUNNINGHAM (*New Zeal. Jour. Agr.*, 23 (1921), Nos. 3, pp. 163-166; 5, pp. 270-276; 24 (1922), Nos. 1, pp. 37-45; 2, pp. 96-102).—The purpose of these articles is to show what scientific names should be definitely accepted (reasons being given for necessary changes), and to attempt the standardization of common names so far as New Zealand is concerned.

Report of the department of plant pathology, M. T. COOK (*New Jersey Stas. Rpt. 1921*, pp. 421-475, pls. 3).—During the period covered by this report, the author states that epidemics were observed of the brown rot of the peach, late blight of the potato, potato scab, cherry leaf spot, eggplant wilt, blackleg of cabbage, streak disease of tomatoes, and a bacterial rot of seed potatoes, mostly due to *Bacillus vulgaris* but complicated in some cases by the occurrence of *Fusarium* sp. and wireworms.

Lists are given of the more important diseases observed during the year, the arrangement being alphabetically by host plants. Detailed reports on some of the investigations are noted elsewhere. A note on leaf scald of shade trees is included.

Injury to foliage by arsenical sprays.—II, Calcium arsenates and arsenites. III, Notes on other arsenicals, H. T. FERNALD and A. I. BOURNE (*Massachusetts Sta. Bul.* 210 (1922), pp. 89–98, figs. 14).—In a previous publication (E. S. R., 47, p. 646) the authors discussed the effect of lead arsenate sprays on foliage. In the present bulletin they give the results of studies with calcium arsenates and arsenites and the factors which appear to cause foliage injury following their use, together with notes on magnesium arsenate and zinc arsenite.

A chemically pure acid calcium arsenate was prepared and sprayed under the same conditions as described in the earlier publication. The evidence seems to show that pure acid calcium arsenate with 1 per cent milk of lime can not be used on the apple at as high temperatures and humidities as the lead arsenates in clear weather. This is true, also, for cloudy weather, although the difference is not so great. On the pear, clear weather tests gave six cases of injury above the safety line, which runs higher than in the case of the apple. In cloudy weather, the pear was more resistant to spray injury than the apple. The leaves of the cherry are more liable to injury than the apple, but less so than the plum. With the plum, temperature seems to play an important part, injury beginning in clear weather and at a low point, while high humidity seems to be less dangerous. The peach was found to follow the plum quite closely in its resistance to calcium arsenate, and the elm was less resistant to pure acid calcium arsenate than the pear.

Commercial calcium arsenate with 1 per cent milk of lime was tested in comparison with the prepared arsenate, and the results obtained are said to indicate that with commercial calcium arsenate the safety lines are about as high as with the pure material, but lower than with the lead arsenates. It is believed that possibly the excess of lime in the commercial calcium arsenate may be sufficient to prevent the arsenic pentoxide from entering into solution. In general, lime arsenate did not give as satisfactory results as the lead arsenates, the range of temperature and humidity combinations at which it is safe to use being more limited. Calcium metarsenite, magnesium arsenate, and zinc arsenite were not found safe to use on fruit tree foliage.

The origin of mosaic, C. E. CHARDÓN (*Rev. Agr. Puerto Rico*, 9 (1922), No. 4, pp. 13–22).—This discussion regarding phases and theories of plant mosaic as noted in different regions concludes with a bibliography of about 30 titles.

The determination of biologic forms of *Puccinia graminis* on *Triticum* spp., E. C. STAKMAN and M. N. LEVINE (*Minnesota Sta. Tech. Bul.* 8 (1922), pp. 3–10, fig. 1).—The authors give a description of the method employed by them for the determination of biologic forms of the stem rust of wheat (*P. graminis*) by the use of differential hosts. From the results of inoculation experiments conducted with a dozen species and varieties of *Triticum*, 37 biologic forms have been recognized.

Barberry eradication in South Dakota, H. C. GILBERT (*S. Dak. State Ent. Ann. Rpt.* 11 (1920), pp. 36–40, figs. 2).—In this report, which is preceded by a discussion by the State entomologist, the author gives an account of the barberry eradication campaign started in 1918 as regards areas, methods, escaped barberries, rust outbreaks traced to barberries, and barberries found in each county of South Dakota during the year.

The efficacy of soaking treatments on wheat smut, A. MORETTINI (*Staz. Sper. Agr. Ital.*, 54 (1921), No. 7–10, pp. 293–315).—As a result of the studies

here outlined, the author concludes that the classic treatment with copper sulphate solution at 0.5 per cent by immersion in the liquid for 15 minutes, followed by neutralization with lime, does not sensibly lower the germinability or germinative energy of the grain. The treatment with copper carbonate or with Caffaro is equally harmless to germinability. In highly affected grain the copper sulphate treatment is superior to the copper carbonate or Caffaro treatment. With grain very slightly infected the dusting treatment is very efficacious.

Oat sickness, J. HUNIG and C. MELJES (*Cultura*, 32 (1920), No. 387, pp. 387-397).—Studies detailed as following those previously noted (E. S. R., 44, p. 49) indicate that oat sickness (dry spot) is not due solely to an alkaline soil reaction, but that it is due exclusively to this in connection with the presence of certain organic materials named. Nitrites do not cause the trouble. Manganese sulphate is said to remedy the condition.

Celery disease investigations, R. F. POOLE (*New Jersey Stat. Rpt. 1921*, pp. 461, 462).—The results are given of experiments on the control of celery diseases, particularly of root rot due to *Bacillus carotovorus*. For the control of this disease, a resistant variety of celery has been secured, and it is being planted with promising results.

Attention was given to damping-off of seedling celery plants due to *Sclerotinia libertiana*, and satisfactory control was obtained in the greenhouse by sterilizing the soil with formaldehyde at the rate of 3 pints of commercial formalin to 50 gal. of water, applied at the rate of 1 gal. per square foot of soil bed.

Studies on eggplant wilt, C. M. HAENSELER (*New Jersey Stat. Rpt. 1921*, pp. 469-472).—It is reported that eggplant growers of southern New Jersey have suffered serious losses due to a wilt caused by a species of *Verticillium*. Experimental studies carried on during the spring and summer of 1920 showed that the fungus was *V. albo-atrum*, and inoculation experiments were carried on which indicated that this was the cause of the wilt in question. Experiments showed that the organism was readily carried over in the soil and also in manure in which eggplant refuse had been composted. A test was made to determine whether the organism was seed borne, but no evidence was found that would indicate that the wilt organism advanced into the seed of the fruit on badly diseased vines. Attempts to infect tomato and pepper plants with the organism taken from wilted eggplants gave negative results.

Investigation of horse-radish root rots, R. F. POOLE (*New Jersey Stat. Rpt. 1921*, pp. 464, 465).—A brief account is given of the occurrence and control of a bacterial disease of horse-radish previously described (E. S. R., 46, p. 548). The investigations have shown that the disease is carried over in winter storage pits, and a large number of counts were made of plants set in the field showing many misses. For control, sulphur and hydrated lime were applied at various rates, but none of the treatments gave satisfactory results.

A study was made of horse radish roots for cuttings, and as a result of experiments it is suggested that the roots should be carefully selected, both ends cut, and those showing disease discoloration rejected. It is recommended that the selected roots be soaked in a corrosive sublimate solution, dried, and planted.

Discovers how to control lettuce "drop", K. H. LANSING (*Seed World*, 12 (1922), No. 9, pp. 20, 21, figs. 2).—W. S. Beach is credited with the statement that formaldehyde has been successfully used for control of lettuce drop in the truck fields of Bustleton under the supervision of the Pennsylvania Experiment Station field laboratories. One gal. per square foot, completely soaking the soil, is sufficient for such treatment. The preparation may be applied

with a sprinkling can or a spray nozzle. A profit of 500 to 1,000 per cent on the cost of application has been realized in experimentation cited. An additional benefit of importance is derived from the improved stand and health of the seedlings that are transplanted to open fields during March in the vicinity of Philadelphia.

Yellow leaf disease in *Phormium tenax*, R. WATERS and E. H. ATKINSON (*New Zeal. Jour. Agr.*, 24 (1922), No. 1, pp. 27-32, figs. 4).—This is a preliminary report on an investigation still in progress. The conclusion is reached that though every endeavor has been made to trace the cause of yellow leaf disease to a specific organism, it can not yet be assumed on the basis of the present knowledge that the disease is due to an organism. It is thought that studies should be applied to environmental conditions.

Tuber and leaf pests [of the potato], C. G. SELVIG (*Minnesota Sta. Crookston Substa. Rpt. 1921*, pp. 63-65).—Brief accounts are given of experiments in treating potato tubers with corrosive sublimate and formaldehyde for the control of scab and black scurf and on the effect of varying numbers of applications of Bordeaux mixture on the yield of potatoes.

Treating the tubers either before or after cutting increased the percentage of marketable tubers and reduced very materially the amount of scab and black scurf. Little difference was noted in yield between plats having two applications and those having four applications of Bordeaux mixture. However, there was a gain at the rate of 28.8 bu. per acre where the plat was sprayed twice as compared with the yield of the check plat.

Diseases of the potato, B. T. DICKSON (*Quebec Soc. Protect. Plants, Ann. Rpt.*, 14 (1921-22), pp. 67-105, figs. 12).—Potato diseases causing losses amounting to millions of dollars annually are outlined in a systematic manner according to the character of their causation, which is partly nonparasitic. Causal organisms named in connection with diseases include *Spongospora subterranea*, *Bacillus atrosepticus*, *Chrysophlyctis endobiotica*, *Pythium debaryanum*, *Phytophthora infestans*, *Sclerotinia libertiana*, *Corticium vagum*, *Alternaria solani*, *Fusarium oxysporum*, *Actinomyces scabicus*, *Oospora pustulans*, *Spondylocadium atrovirens*, *Fusarium* spp., and *Vermicularia varians*. Troubles due to physiological or other causes are briefly discussed.

Potato canker, C. J. J. VAN HALL (*Teymannia*, 32 (1921), No. 2, pp. 62-64).—Potato wart (*Chrysophlyctis endobiotica*), which has been noted in five different places in the Netherlands and in parts of other European countries indicated, has not yet appeared in the Dutch East Indies.

Report of potato-spraying tests, W. H. MARTIN (*New Jersey Stas. Rpt. 1921*, pp. 435-441).—In continuation of experiments previously reported (*E. S. R.*, 46, p. 548), the author gives an account of cooperative spraying tests in which various strengths of Bordeaux mixture and the dates of applications were compared.

No late blight appeared during the season, but there was considerable tipburn and early blight. The results obtained were decidedly in favor of the use of a 5-5-50 Bordeaux mixture. When the dates and number of applications were considered, the results showed conclusively the importance of late spraying. A series of experiments with the Irish Cobbler and the American Giant varieties of potatoes grown as a late crop for seed purposes showed that five applications of a 5-5-50 Bordeaux mixture increased the yield of both varieties.

Inoculated v. uninoculated sulphur for the control of potato scab, W. H. MARTIN (*New Jersey Stas. Rpt. 1921*, pp. 449-452).—In view of the fact that the efficiency of sulphur for potato scab control results from its oxidation, experiments were conducted in which the value of commercial sulphur was com-

pared with sulphur inoculated with soil known to contain sulphur-oxidizing organisms. Three series of tests are reported in which, in general, the total yield and proportion of clean tubers were greatest for the plats that received the inoculated sulphur. The H-ion concentration of the soil extract was changed by the application of sulphur, the greatest difference being, as a rule, where inoculated sulphur was employed.

The influence of sulphur on the control of potato scab, W. H. MARTIN (*New Jersey Stas. Rpt. 1921, pp. 442-448*).—Experiments with the application of sulphur at the rate of 300 and 600 lbs. per acre for the control of potato scab gave, in 4 out of 6 experiments, a lower total yield of potatoes where 300 lbs. of sulphur were applied, but in all but one case there was an increased yield where 600 lbs. were used. In every instance the percentage of clean tubers was increased over the check lots where sulphur at either rate was applied. The H-ion concentration of the soil extract was progressively reduced by the application of sulphur to the soil.

Potato scurf, E. FOËX (*Jour. Agr. Prat., n. ser., 38 (1922), Nos. 29, pp. 73-75, pl. 1; 30, pp. 93, 94; 31, pp. 111-113*).—An account dealing also with resistance of potato varieties to scab or scurf in the forms ordinarily designated as common (*Actinomyces* sp.), powdery (*Spongospora subterranea*), or Rhizoctonia scab (*Hypochnus solani, Rhizoctonia solani*), concludes by recommending 0.1 per cent mercuric chlorid as the most efficacious seed tuber disinfectant and commercial (40 per cent) formalin as almost equally successful when diluted to a strength of 0.5 per cent and used to immerse the seed tubers for two hours.

Helminthosporium disease of rice, S SUNDARARAMAN (*Agr. Research Inst., Pusa, Bul. 128 (1922), pp. 7+4, pls. 4*).—During the year 1918-19 the paddy crop in the deltaic tracts of Godavari and Kistana suffered heavy damage. Heavy rain occurred during November and December when the ear heads had formed or were being formed, and the paddy fields were under water for several days owing to poor drainage. The crop was found to be suffering from attacks of stem borer, silver shoot, and Helminthosporium leaf-spot disease, which was found particularly in fields where the growth was very poor. With this disease the present paper deals principally.

H. macrocarpum, H. sigmoidium, and *H. oryzae* are discussed in relation to the present species. The Helminthosporium fungus, here involved, forms dark brown disease spots on leaves, leaf sheaths, and glumes. The weather largely conditions the development and spread of the disease. Spores germinate readily in water. Inoculations on leaves, leaf sheaths, and ear heads produced the infection, forming disease spots which did not develop notably. The results of the several inoculations go to confirm the field observations that the fungus is a weak parasite under normal conditions, and that the disease is not of such a severe nature as to cause very serious crop losses.

Seedling blight and stack burn of rice and the hot water seed treatment, W. H. TISDALE (*U. S. Dept. Agr. Bul. 1116 (1922), pp. 11, pls. 6, figs. 2*).—The rice crop in the southern part of the United States is said to suffer heavy annual losses due to the staining and decay of the grain in the shock and in storage, both before and after milling, and to poor germination of the seed when sown. The disease, to which the names stack burn, stain, and flecking are given, is characterized by the appearance of flecks or totally decayed grains of a yellowish brown to a dark brown color. The seed injury phase of this disease has been previously reported upon (*E. S. R., 36, p. 247*). In a subsequent publication, Godfrey¹ again reported the occurrence of the disease and attributed it to a sterile fungus.

¹ *Phytopathology*, 10 (1920), No. 6, pp. 342, 343.

The author of the present bulletin has undertaken to clear up the question of the cause of the leaf spot and seedling blight, and to offer some suggestions for its prevention. In his investigations, in addition to the sterile fungus, a number of others were found in the seed which were capable of causing staining and decay and a certain percentage of seedling injury. The infection is said to spread if the rice remains shocked under warm, moist conditions.

For the control of the trouble it was found that hot water treatment would kill the fungi carried within the seed and not injure the viability of the seed if proper methods were used, but until additional information is obtained regarding the fungi and their life histories, it is considered inadvisable to recommend seed treatment which would kill only the fungi in the seed. Where infested seed is to be sown on virgin soil or where rice has not been previously grown, it might be of advantage to treat the seed to prevent the introduction of the fungi into new lands. From a commercial standpoint, hot water treatment is believed to be too tedious and expensive. The most promising solution is believed to be the development of resistant strains and varieties.

Investigation of sweet-potato diseases, R. F. POOLE (*New Jersey Stat. Rpt. 1921, pp. 466-468*).—As a result of one year's work, the author reports satisfactory control of the stem rot of sweet potatoes which was secured by field examination of the sweet potatoes, all roots produced by vines showing discoloration being rejected. Brief notes are given of investigations in progress on soil rot, soil stain or scurf, black rot, and stem rot.

Wildfire of tobacco, F. A. WOLF (*North Carolina Sta. Bul. 246 (1922), pp. 27, figs. 7*).—In continuation of previous reports on tobacco wildfire and the organism causing it, *Bacterium tabacum* (E. S. R., 38, p. 852; 46, p. 739), the author has brought together the essential data that have since appeared regarding the economic importance, distribution, life history, etc., of the organism and means for its control.

For the control of this disease, which is said to be of great economic importance and widely distributed, the author recommends the use of seed of known healthy origin, making new plant beds each year or thoroughly sterilizing the soil, the use of new plant bed covers or the sterilization of the old ones, avoiding infection by handling of the plants, and spraying or dusting the plant beds with Bordeaux mixture. No diseased plants should be set in the field, nor should the crop be planted in fields which have grown a diseased crop during the previous year. Experiments have shown that spraying in the field has not given satisfactory results, and that low topping should be avoided. The removal or pruning of affected leaves is considered of doubtful value.

[**Tomato spraying experiments**], R. F. POOLE (*New Jersey Stat. Rpt. 1921, p. 463*).—In continuation of work previously reported (E. S. R., 45, p. 249), the author gives an account of spraying experiments with Bordeaux mixture of different strengths for the control of tomato leaf spots and other diseases. As the data given are rather conflicting, the experiments are to be repeated.

Phacidiella discolor, A. OSTERWALDER (*Centbl. Bakt. [etc.], 2. Abt., 52 (1920), No. 16-17, pp. 373-375, fig. 1*).—During the winter preceding this report, *P. discolor*, previously causing only slight injury in isolated cases, was much more common, causing a rot of seed fruits, particularly pears. This fungus is considered a wound parasite.

Résumé of pear blight history and methods of control, D. G. MILBRATH (*Calif. Dept. Agr. Mo. Bul., 11 (1922), No. 10, pp. 760-765*).—Pear blight (*Bacillus amylovorus*) is estimated to have caused losses in California for 1922 amounting to from 5 to 10 per cent of the crop, besides the injury done to the trees and the expense of control measures. A general account is given of the disease, its history, distribution, and control.

Spraying experiment for the control of pear fruit and leaf spot, C. M. HAENSELER (*New Jersey Stat. Rpt. 1921, pp. 473, 474*).—The results are given of a spraying experiment with commercial lime sulphur, Bordeaux mixture, self-boiled lime sulphur, and Pyrox for the control of pear fruit and leaf spot caused by *Fabrea maculata*. The self-boiled lime sulphur did not injure the fruit and produced satisfactory control, and as a consequence it was thought that this mixture could be more safely used than the other fungicides employed, which gave complete control, but caused more or less spray injury to the fruit. Until more definite information is obtained regarding spraying, it is suggested that four applications of self-boiled lime sulphur be given the trees, beginning about 10 days after petal fall and following at from 10- to 14-day intervals, with the last spray to be applied about 3 weeks after the third application.

Control of peach scab, H. R. STANFORD (*Calif. Dept. Agr. Mo. Bul., 11 (1922), No. 10, pp. 765-774, figs. 5*).—Peach scab (*Cladosporium carpophilum*) continuing to increase in parts of California, work was undertaken in connection with G. P. Weldon on several problems relating to the disease, including prevalence, varietal resistance, effect on grade and price, and control measures. Some phases of these problems are discussed in the present account, with the data obtained.

It was clearly demonstrated that it is possible to control scab with one spraying (self-boiled lime sulphur) for the earlier varieties and two for the later sorts; though where the disease has been severe in past seasons and abundant infection is found on the twigs, it is economical to give at least one spraying in the spring.

A fungus disease attacking blackberry, G. H. CUNNINGHAM (*New Zeal. Jour. Agr., 24 (1922), No. 1, pp. 23-26*).—As a result of an investigation regarding the causation and extent of raspberry cane wilt in New Zealand, it is stated that although *Leptosphaeria coniothyrium* occasions heavy loss in certain seasons it causes little or no damage to the blackberry plants, though severe infection may entirely prevent fruiting on certain varieties.

Avocado die-back, W. T. POPE (*Hawaii Sta. Rpt. 1921, p. 12*).—A brief account is given of die-back of avocados as it occurs in Hawaii and elsewhere. The disease is thought to be due to a number of causes, and it is claimed that it may usually be prevented by giving the trees good culture, planting them in a location that is well sheltered from wind, has a soil rich in organic matter, and is supplied with good underdrainage.

Studies on the so-called smut of white flg varieties, E. H. SMITH and E. H. PHILLIPS (*Calif. Dept. Agr. Mo. Bul., 11 (1922), No. 10, pp. 755-758, figs. 3*).—An investigation near Fresno of flg diseases, particularly smut, is outlined as applying to 10 types or stages of ripening which are indicated, with the results of inoculation in each stage. All indications point to insects rather than to wind as spore carriers, though a premature rain is supposed to have played an important part in trees where the smut was well under way.

Pineapple-wilt experiment, J. C. RIPPERTON (*Hawaii Sta. Rpt. 1921, pp. 36, 37*).—The results are given of a series of plot experiments with fertilizers applied in various combinations for the control of pineapple wilt, but no definite influence on the proportion of the diseased plants was noted. Spraying has thus far given no decided benefit.

Red rust, T. PETCH (*Planters' Chron., 16 (1921), No. 32, pp. 532-538*).—In the lecture here briefly reported with discussion, the author gave an account of tea red rust as observed locally in regard to the characters and results of the disease, which has been known for nearly 20 years in Ceylon and nearly twice as long in India.

Disease of chestnut trees new to California, C. E. SCOTT (*Calif. Dept. Agr. Mo. Bul.*, 11 (1922), No. 10, pp. 740, 741).—A chestnut tree disease, noted in the vicinity of Grass Valley, Calif., as resembling in some respects that due to *Endothia parasitica*, which is destroying the chestnuts in eastern States, though apparently caused by *Fusicoccum* sp., is briefly discussed.

Apparently the fungus enters by way of wounds. It grows in the inner bark, more rapidly lengthwise the branch, which tends to be girdled and killed.

Oak Oidium on chestnut, A. MANARESI (*Staz. Sper. Agr. Ital.*, 54 (1921), No. 7-10, pp. 289-292).—Young chestnuts are injured by a fungus, apparently very similar to *O. quercinum*, attacking the leaves and other parts.

Gummosis in the rubber plant, B. PALM (*Teysmannia*, 32 (1921), No. 1, pp. 31-33, pl. 1).—A gummosis is reported as attacking young *Manihot glaziovii* at Buttenzorg. The disease is said to be caused by *Bacillus solanacearum*.

White pine blister rust quarantine, S. B. DETWILER (*Calif. Dept. Agr. Mo. Bul.*, 10 (1921), No. 7, pp. 265-271).—Reporting on the progress of the white pine blister rust quarantine and control work, the author states that much good was accomplished during the previous 5 years. In New Hampshire the cost per acre of eradicating currants and gooseberries decreased from 42 cts. in 1917 to 17.5 cts in 1920. Crews doing regular work removed 99 per cent of the bushes. The work in the Eastern States has proved to be effective in preventing the spread of the blister rust.

The spores which affect the pine are very delicate, dying on the producing host in snowy weather and living not over 10 minutes in cloudy, humid weather, so that removal of currant bushes within 200 or 300 ft. of pines protects these effectually.

Note on the death of chir poles in the Almora plantations of Kumaun, H. G. CHAMPION (*Indian Forester*, 48 (1922), Nos. 4, pp. 168-174, pl. 1; 5, pp. 232-236).—Extensive dying out of young pines (*Pinus longifolia*) planted about 1875 has been going on locally for several years, the present account relating chiefly to personal observations beginning in 1916 and applying mainly to trees systematically marked and examined. Details are given as to the distribution of the mortality, the possible causes, including fungi and insects, and the control measures tried or suggested, such measures including chiefly immediate destruction of trees showing signs of discoloration.

Studies in wood decay.—I, **Laboratory tests on the relative durability of some western coniferous woods with particular reference to those growing in Idaho**, H. SCHMITZ and A. S. DANIELS (*Idaho Univ. School Forestry Bul.* 1 (1921), pp. 11).—The previous work of Schmitz (*E. S. R.*, 44, p. 26) having proved that a great difference may appear between the results obtained from laboratory pure culture methods and those obtained under natural conditions complicated by the presence of ordinary types of microorganisms, the authors inaugurated the present study to test the relative durability under laboratory conditions of the more important coniferous woods found in Idaho with the hope of extending the use of the so-called inferior species.

The species of woods selected because of their apparent wide diversity as to durability and their importance commercially in this region were western white pine (*Pinus monticola*), western yellow pine (*P. ponderosa*), Douglas fir (*Pseudotsuga taxifolia*), western larch (*Larix occidentalis*), western red cedar (*Thuja plicata*), white fir (*Abies grandis*), and Engelmann spruce (*Picea engelmanni*), the fungi used being *Polyporus lucidus*, *Lenzites sepiaria*, *Fomes pinicola*, *Merulius pinastri*, *Polystictus versicolor*, *Pleurotus sapidus*, *Echinodontium tinctorium*, *Trametes pini*, *T. carnea*, and *Lentinus lepidus*. These were employed in inoculation tests and then to incubation for 10.5 months under conditions supposedly favorable to rotting.

The results, as regards loss of weight due to these rotting fungi, average 7.2 per cent only, although white and yellow pine lose more (16.1 and 11.8 per cent). Douglas fir represented the average loss. Engelmann spruce, white fir, and red cedar fell below the average in the order named. Red cedar showed no appreciable loss in weight during the tests.

The maximum rate of loss was caused by *Lenzites sepiaria* on white pine. Fungi showing less and less rot in the order named were *Lentinus lepideus* on yellow pine, *L. lepideus* on white pine, *Lenzites sepiaria* on yellow pine, and *F. pinicola* on white pine.

White fir, usually recorded as being very susceptible to decay, was here surpassed in resistance only by red cedar, which showed no loss with any of the fungi used. The most destructive fungus is *L. sepiaria*.

Studies in wood decay.—II, Enzym action in *Polyporus volvatus* and *Fomes igniarius*. H. SCHMITZ (*Jour. Gen. Physiol.*, 3 (1921), No. 6, pp. 795–800).—In this paper, said to be the third of a series (E. S. R., 44, p. 27), dealing with enzym action in the wood-destroying fungi, and the second of a series of papers (see above) planned by the laboratory of forest products, circumstantial evidence is presented which indicates that *P. volvatus* is parasitic.

Cultures of *P. volvatus* and *F. igniarius* may be obtained from the young sporophores by the tissue method. In *P. volvatus* and *F. igniarius* the presence was demonstrated of the enzymes esterase, maltase, lactase, sucrase, raffinase, diastase, inulase, cellulase, hemicellulase, glucosidase, rennet, and catalase. *F. igniarius* also contained urease.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Report of the department of entomology, T. J. HEADLEE ET AL. (*New Jersey Stas. Rpt. 1921*, pp. 351–419, figs. 4).—A tabulated list of 172 species of insects, inquiries concerning which were made during the year, is followed by notes on some of the more important pests occurring during the period under report, including plant lice, the pear psylla, codling moth, oriental peach moth, rose chafer, potato flea-beetle, plum curculio, green Japanese beetle (*Popillia japonica*), and the gipsy moth. A brief reference is made to the work conducted against the gipsy moth under an emergency appropriation of \$112,000 by the State legislature in cooperation with the U. S. D. A. Bureau of Entomology, an account of which has been previously noted (E. S. R., 45, p. 255).

An account is given of climate and insect investigations, in which the results obtained in three series of experiments on the effect of atmospheric moisture upon the rate of metabolism of the bean weevil are summarized, progress reports of which have been noted (E. S. R., 46, p. 661). In an investigation of the effect of the loss of water on the viability of beans, corn, and peas, it was found that the reduction in water content is accompanied by a slow decrease in the viability, and that when the water content of beans, corn, and peas is reduced more than 45, 90, and 65 per cent, respectively, the increase of germination becomes serious. A determination of the hygroscopic power of certain common cheap substances, such as calcium oxid, calcium chlorid, calcium hydroxid, and Milltown ball clay No. 9 showed that an exposure of these substances from April 18 to April 25 to an air stream containing 73 per cent of atmospheric moisture resulted in a gain for calcium chlorid of 126.8 per cent, for calcium oxid 30.5 per cent, for calcium hydroxid 0.15 per cent, and for clay 0.15 per cent. By placing beans in containers with definite amounts of each of these substances, but separated therefrom by a thick layer of cotton, it was determined that calcium oxid is the only one of the four which exhibits much effect as a dehydrator. When mixed directly with beans it was found that

none was satisfactory as a dehydrator, but that Milltown ball clay was the best from all points of view when used as a contact protection for the seed.

In dusting experiments on the peach materials applied dry seemed almost as efficient in the control of the common insects as those applied in water, but on the apple liquid applications were far more effective. It appears to have been shown that nicotin-impregnated dusts will destroy high percentages of the oat aphid and the apple leafhopper. Brood studies of the codling moth for the years 1919 to 1921, which are summarized diagrammatically, indicate the occurrence of only two broods annually. The progress of codling moth control experiments, outlined in a previous report (E. S. R., 46, p. 555), is reported upon in tabular form, the final results of which will be set forth in the report of the succeeding year.

Experiments with various substances for the control of the peach borer are reported upon by A. Peterson (pp. 378-388). The substances used were gipsy moth tree-banding material, asphalt compounds, Borowax, pine tar, hydrated lime, Borericide, mercuric chlorid, sodium sulphocarbonate, sodium cyanid, orthodichlorobenzene, and paradichlorobenzene, of which the first four named were used exclusively on 1 and 4 year-old peach trees. The results, which are summarized for each material, led to the conclusion that, while the control of this pest is still in the experimental stage, yet paradichlorobenzene can be recommended for use on trees 6 years of age or older. Satisfactory results were also obtained with exposures of 14 to 21 days on trees 3 to 6 years of age. Detailed reports of experiments with this insecticide by the author have been noted (E. S. R., 45, p. 758; 46, p. 156).

A brief reference is made to sewage investigations of the year, in which the plants and animals found in the sprinkling sewer filter are recorded. Cranberry investigations relating to plant food and the effect of flooding on the plant are noted on page 343. The mosquito work, by Headlee and W. M. Walden (pp. 409-419), resulted in the discovery and elimination of mosquito breeding on 120,000 acres of salt marsh and 320,000 acres of upland, the maintenance of drainage systems, etc.

Report of the entomologist, C. E. WILSON (*Virgin Islands Sta. Rpt. 1921, pp. 12-24*).—The first part of this report consists of a tabulated account of truck-crop, fruit, and field-crop pests occurring in the Virgin Islands, arranged by host plants and including the common and Latin names of the insects, with remarks on their occurrence and the nature of their injury. To the scale insects listed in the report of the previous year (E. S. R., 45, p. 149), the author adds the ground pearl (*Margarodes formicarum*), which is present in great numbers in sugar cane stools. Three species of mosquitoes have been found in St. Croix, the yellow fever mosquito (*Aedes (Stegomyia) aegypti*), the malaria mosquito (*Anopheles albimanus*), and the common house mosquito (*Culex quinquefasciatus*). A list is given of 21 coccids attacking ornamentals in the Virgin Islands. A white ant (*Cryptotermes* sp.) was a serious pest of lumber, and caused considerable damage by tunneling into the sills, rafters, floors, and ceilings of houses and through books and magazines. The beetle *Schistocerus cornutus* was destructive to fence posts and stakes. A summary of information on insect control is included.

Insect and arachnid pests of 1921, R. S. MACDOUGALL (*Highland and Agr. Soc. Scot. Trans., 5. ser., 34 (1922), pp. 157-195, figs. 29*).—This is a summary of observations on the more important pests of the year.

[Economic insects and birds and their control in Hawaii], W. T. POPE and H. L. CHUNG (*Hawaii Sta. Rpt. 1921, pp. 24, 25, 33-35, fig. 1*).—In spraying experiments, the red spider and another injurious mite were controlled by sulphur sprays. A spray consisting of 1.75 lbs. of whale-oil soap and 10 oz.

of nicotin sulphate to 50 gal. of water, applied as soon as the attacks were discovered, gave satisfactory control when three or four applications were made with intervals of 10 days. The common mealybug, which attacks the maturing fruit of the late mangoes, was readily controlled by the application of San-U-Zay oil at the rate of 1 gal. to 30 gal. of water. The picking up and burning of infested mangoes was found to be a very effective means for controlling the mango weevil. The application of arsenate of lead at the rate of 0.5 oz. in the paste form to 1 gal. of water was effective against the green caterpillar of *Plusia chalcites*, a foliage-eating insect, and its application also reduced the attacks of the Japanese beetle.

The English sparrow was a source of considerable injury to the bean and corn crops at the station during the year through shelling the beans in the green stage and removing the green corn shucks at the tip. The rice bird (*Munia nisoria*) was also a source of considerable damage at the station, having shelled the green seed pods for the matured seed of Chinese cabbage grown for seed production.

The corn leafhopper (*Peregrinus maidis*) severely damaged the entire corn crops of varieties other than Cuban Red and Guam varieties, which were not attacked. Brief mention is also made of the imported cabbage worm, which was parasitized by *Frontina archipinnora*, of the weevils *Bruchus chinensis* and *Calandra oryza*, and the cane leafhopper (*Perkinsiella saccharicida*).

A host index of insects injurious to Philippine crops, H. E. WOODWORTH (*Philippine Agr.*, 10 (1921), No. 1, pp. 9-35; 10 (1922), No. 7, pp. 321-329; 11 (1922), No. 2, pp. 49-55).—This host index of insects, arranged in alphabetical order, includes many insects that are recorded for the first time as injurious to crops in the Philippines.

The food plants or hosts of some Fijian insects, R. VEITCH and W. GREENWOOD (*Linn. Soc. N. S. Wales, Proc.*, 46 (1921), pt. 4, pp. 505-517).—This is a host list for a number of parasitic, predaceous, and bloodsucking insects made during the course of investigations of sugar cane pests in the Fiji Islands.

The insects of sugar cane in the Dominican Republic, G. N. WOLCOTT (*Jour. Dept. Agr. and Labor Porto Rico*, 6 (1922), No. 1, pp. 32-37, pl. 1).—This is an annotated list of 32 forms attacking sugar cane in the Dominican Republic.

Mosaic cross inoculation and insect transmission studies, O. H. ELMER (*Science*, 56 (1922), No. 1448, pp. 370-372).—Experiments in which aphids on legumes, mainly cowpeas, infected with mosaic were transferred to healthy plants have shown the disease to be transmissible, all of 38 cowpea seedlings having become infected, while all checks remained healthy. Numerous experiments have shown that the mealybug also transmits the disease. Thus mealybugs from mosaic crookneck squash plants which were transferred to two pots containing 33 cowpea plants gave 100 per cent infection, while all checks remained healthy. Two tobacco plants and a tomato plant in the greenhouse were infected with mosaic from crookneck squash through the agency of mealybugs, showing that the mosaic may be transmitted to solanums.

Mites injurious to domestic animals, S. HIRST (*Brit. Mus. (Nat. Hist.), Econ. Ser.*, No. 13 (1922), pp. 107, figs. 85).—The author gives illustrated descriptions of the mites attacking domestic animals and the nature of the affection resulting from their attack. Pen drawings are given of the forms considered. In an appendix (pp. 94-103) an account is given of the acarine disease of hive bees caused by *Acarapis woodi* Ren.

Leafhopper injury to potatoes, J. E. KOTILA (*Michigan Sta. Tech. Bul.* 56 (1922), pp. 27, figs. 14).—This is a report of studies of the life history and habits and of methods of control for *Empoasca malt* LeB. on potatoes, in

which the literature relating to this pest and hopperburn is reviewed. The production of the disease in both field and greenhouse experiments is reported, largely in tabular form, followed by descriptions of its several stages and a report of observations of its life history and habits.

The author concludes that hopperburn is the greatest factor in reducing Michigan potato yields during dry seasons, and that "tipburn" if present at all is of minor importance. Experiments conducted during the winter of 1919-20 and collections and observations during the spring of 1920 indicate that the potato leafhopper hibernates in Michigan as an adult and not in the egg stage. There were found to be two complete generations each season in Michigan, approximately one month elapsing from the time the eggs are laid until the nymphs develop into adults.

Control and remedial measures, including both spraying and dusting, are reported upon. The time of planting was found to have a marked effect on the amount of hopperburn in the field, fields planted after June 15, in the Upper Peninsula, having shown but little injury. Early varieties were found to be more susceptible to hopperburn than late varieties, the rural types appearing to be the most resistant. The pest was repelled and hopperburn was controlled by spraying the vines with 4-4-50 Bordeaux mixture. Dehydrated copper sulphate and lime dust and dusts impregnated with nicotine give some promise for control, but can not yet be recommended to replace spraying with Bordeaux mixture. It is recommended that the first application of Bordeaux be made when the vines are from 3 to 6 in. high, to be followed by a second spraying about a week later and three subsequent applications at intervals of 10 days to 2 weeks.

A bibliography of 25 titles is included.

The adult habits of the apple sucker (*Psyllia mali* Sch.), W. H. BRITAIN (*Sci. Agr.*, 3 (1922), No. 2, pp. 59-64).—In this paper the author reports observations of the migration and distribution, rate of reinfestation, etc., much of the data being presented in tabular form.

The white flies of hothouses (*Kentucky Sta. Bul.* 241 (1922), pp. 77-111, figs. 10).—In the first part of this bulletin (pp. 77-81) H. Garman deals with the banded-wing white fly (*Asterochiton abutilonea* Hald.). This is followed by a report of studies of the greenhouse white fly (*A. vaporariorum* West) by H. H. Jewett (pp. 82-103).

The banded-wing white fly of greenhouses in Kentucky is thought to be a native species, which occurs out of doors on a common weed known as velvet leaf (*Abutilon theophrasti*), but deserts its host for other plants. Indoors this species feeds on almost any plant available but shows a preference for leguminous plants. Its invasion of greenhouses is due to the presence of its favorite host plant in the vicinity during the fall months when ventilators must be kept open. The young of this species are translucent whitish, with a yellow spot on each side behind the middle of the body. As the insect settles down on the leaf it begins to secrete from close-placed round pores at its sides a marginal fringe which finally becomes the side wall of the pupa case. With growth, other secretions appear at the dorsal edge of the body forming finally a fringe of translucent setae, and the whole central dorsal region of the integument becomes black, a character by which it can be distinguished at a glance from *A. vaporariorum*.

Studies of the biology and control of *A. vaporariorum*, commenced in 1914, are reported upon with tabular records of rearings. Brief references are made to the parasites of this white fly, particularly *Encarsia pergandiella*, and to details of fumigation and contact spray experiments. The results of such experiments with potassium cyanid, sodium cyanid, paradichlorobenzene, paradichlo-

robenzene and acetone, paradichlorobenzene and carbon tetrachlorid, kerosene emulsion, Schnarr's insecticide, and whale-oil soap are reported in tabular form. These experiments have led the author to recommend the use of hydrocyanic acid gas, two or three fumigations being necessary to rid the greenhouses entirely of the pest, since its eggs are not destroyed by the gas. Where it is not practicable to fumigate, frequent spraying with a soap solution made by dissolving one or two ounces of soap in a gallon of water will aid in keeping the insect under control. A list of 40 references to the literature on *A. vaporariorum* is appended.

Some Malayan Aphididae, R. TAKAHASHI (*Philippine Jour. Sci.*, 21 (1922), No. 5, pp. 421, 422).—The author records four species of aphids collected in the vicinity of Johore, Malay Peninsula, making an addition to the 11 species previously recorded from the Federated Malay States by Van der Goot (E. S. R., 43, p. 452).

A review of Green's The Coccidae of Ceylon, G. F. FERRIS (*Canad. Ent.*, 54 (1922), No. 11, pp. 246-248).—This is a review of the work previously noted (E. S. R., 48, p. 154).

List of natural enemies of the celery leaf-tier (*Phlyctaenia rubigalis* Guen.), F. H. CHITTENDEN (*Canad. Ent.*, 54 (1922), No. 8, p. 174).—The author presents an annotated list of 12 parasites known to attack the celery leaf-tier.

The caterpillars which eat the leaves of sugar cane in Porto Rico, T. H. JONES and G. N. WOLCOTT (*Jour. Dept. Agr. and Labor Porto Rico*, 6 (1922), No. 1, pp. 38-50, figs. 10).—The author gives brief accounts of seven species of lepidopterous larvae known to feed on the leaves of sugar cane in Porto Rico, namely, *Prenes nero* Fab., *P. ares* Feld., *Atrytone vittellus* Fab., *Cirphis* (*Heliothia*) *latuscula* H. S., *Laphygma frugiperda* S. & A., and *Remigia* (*Mocis*) *repanda* Fab. These leaf-feeding caterpillars are of rather minor importance, due largely to their natural control by parasites.

The influence of the variety of sugar cane on its infestation by *Diatraea saccharalis*, and the other factors affecting the abundance of the moth borer, G. N. WOLCOTT (*Jour. Dept. Agr. and Labor Porto Rico*, 6 (1922), No. 1, pp. 21-31, figs. 2).—This is a summary of knowledge of the habits and of the abundance of the sugar-cane borer, as affected by the methods of cane cultivation practiced in Porto Rico, the varieties grown, and, incidentally, by the rainfall.

Some observations of the gray pyralid of larch (*Steganoptycha pinicolana* Zhl.), BADOUX (*Jour. Forest. Suisse*, 73 (1922), No. 1, pp. 1-6, pl. 1).—A report is given of observations of the biology of this pest and of its attack, particularly upon larch.

Pathology of the dermatitis caused by *Megalopyge opercularis*, a Texan caterpillar, N. C. FOOT (*Jour. Expt. Med.*, 35 (1922), No. 5, pp. 737-753, pls. 2).—This is a report of studies of a slug caterpillar known in southern Texas as the puss-caterpillar or opossum bug, which during the past decade has been causing dermatitis, and particularly during the years 1913 and 1920.

"The dermatitis caused by contact with the larva of *M. opercularis* is produced by a poison introduced by the hollow, specialized setae of its cuticular tubercles. It is not produced by the ornamental hairs, or by the tissue juices of the animal. The poison appears to be of the nature of a venom, combined with protein vehicles, and may be itself a protein. It is rendered inert by boiling, or by heating to 55° C. [131° F.] for a considerable period of time. It is apparently stored in sacs at the base of the setae, but whether secreted there or by hypodermal glands remains to be determined. It diminishes in virulence after the larva has spun its cocoon, and is no longer active after the

caterpillar is dead. The poisonous spines cause localized necrosis of the human epidermis, followed by the formation of small vesicles. The cellular reaction to the poison is chiefly lymphocytic."

Occurrence and control of the corn earworm in alfalfa, W. H. LARRIMER (*Canad. Ent.*, 54 (1922), No 8, pp. 169, 170).—The bollworm is reported to have been generally more abundant over the Central States during the season of 1921 than for many years. Late in the season it had become a very serious pest to the commonly attacked food plants, but was especially destructive in young alfalfa fields. An infestation occurred in a young alfalfa field near St. Joseph, Mich., in which on October 3 practically every leaf had been stripped from the young plants. The application of a poison bran mash consisting of 25 lbs. of bran, 0.75 lb. Paris green, 2 qt. molasses, and about 3 gal. of water mixed and applied to 5 acres resulted in the destruction of 75 per cent or more of the worms, despite unfavorable weather conditions.

Codling moth experiments (*Jour. Dept. Agr. Victoria*, 20 (1922), No. 10, pp. 583-589).—This is a report, largely in tabular form, of experimental control work with sprays during the season 1920-21, when the pest was quite abundant.

Codling moth and superheating, R. C. TREHERNE (*Brit. Columbia Fruit-growers' Assoc. Ann. Rpt.*, 32 (1921), pp. 56-62).—This is a discussion of the codling-moth situation in the Okanogan Valley of British Columbia and of the control work under way. It has been found that sweepings from railway cars containing codling-moth material are the most important factor in introducing the insect into the valley, it being estimated that 80 per cent of the infestations have originated from larvæ in refrigerator cars. It is reported that experiments have been conducted which point clearly to the fact that the larvæ may be destroyed by steam heat varying from 140 to 160° F. for 15 to 20 minutes. No damage to the refrigerator cars from these temperatures for this length of time has been noted providing the cars are in good repair.

The use of nutrient agar for rearing dipterous larvae, R. C. SHANNON (*Amer. Jour. Trop. Med.*, 2 (1922), No. 6, pp. 555-557).—The author finds ordinary nutrient agar to be a suitable medium for the rearing of tabanid larvæ and for certain of the muscoids.

A new cecidomyiid parasite of the white fly, E. P. FELT (*U. S. Natl. Mus. Proc.*, 61 (1922), Art. 23, pp. 2).—Under the name *Cleodiplosis aleyrodicti* n. sp., the author describes an itonidid which was reared in considerable numbers from *Aleyrocyus chagentios* at Panama City.

An experimental investigation of the supposed poisonous qualities of the Colorado potato beetle *Leptinotarsa decemlineata*, F. DEFIEL (*Amer. Jour. Trop. Med.*, 2 (1922), No. 6, pp. 559-567).—The author has failed to find experimental evidence to support the belief that the Colorado potato beetle contains a substance poisonous to inhale or ingest.

Australian sugar cane beetles and their allies, J. F. ILLINGWORTH and A. P. DODD (*Queensland Bur. Sugar Expt. Stas., Div. Ent. Bul.* 16 (1921), pp. 104, pls. 17).—This work consists of the following papers: The Greyback Cane Beetle, *Lepidoderma albohirtum* Waterh., by Illingworth (pp. 5-28); A Study of Some of the Common Trees in Their Relation to the Aerial Life of the Beetles, by Dodd (pp. 29-43); *Lepidiota frenchi* Blackb. (pp. 44-51); Related Cane Beetles and Their Allies, by Dodd (pp. 52-73); A Comparison of the Male Genitalia of Cane Beetles (p. 74); A Study of the Factors of Control (pp. 75-84); and an annotated bibliography of 110 titles.

A laboratory note on the control of *Trogoderma khapra*, T. PARKER and A. W. LONG (*Bur. Bio-Technol., Leeds, Bul.* 4 (1921), pp. 102-104).—Experimental work carried out in order to find a really effective fumigant which can

be used against this pest in the bins while the malt is still contained therein has led to the following conclusions:

Pentachlorethane can be successfully used for killing free larvae in the bins, but does not kill those insects living in the interior of the grain. Chloropierin is more effective for killing the larvae but is more unpleasant to use, and further experiments are necessary to determine its effect upon malt. It has been used quite successfully for destroying weevils in barley, but most certainly affects the germinating powers of the barley. Most of the pentachlorethane may be removed from treated malt by thoroughly redrying on the kiln, the malt meanwhile being repeatedly turned, and any remaining traces are finally dispelled when the wort is boiled in the open coppers, no deleterious effect being produced upon the ultimate taste of fermented liquors.

Life history and habits of some common Philippine flea-beetles, F. RAMIREZ REVECHE (*Philippine Agr.*, 11 (1922), No. 2, pp. 29-48, pls. 4).—The flea-beetles, the life history and habits of which have been studied and are here reported upon, partly in tabular form, include *Psylliodes balyi* Jac., *P. splendida* Har., and *Nisotra gemella* Erichs. Miscellaneous notes are presented on several other species of flea-beetle. A list of host plants of flea-beetles and accounts of experimental control work are included, together with a bibliography of 24 titles.

The cocklebur billbug, F. H. CHITTENDEN (*Canad. Ent.*, 54 (1922), No. 10, pp. 217-220, figs. 2). This is an account of *Rhodobaenus 13-punctatus* Ill., which attacks the cultivated sunflower in Kansas and neighboring States. It has a wide distribution, occurring from the Atlantic to the Gulf regions, and it is about equally common on the Pacific Coast. It breeds in the stems of various wild plants, chiefly Compositae, a list of eight in which it has been observed being presented by the author. The chalcidid *Habrocytus rhodobaeni* Ashm. and a second undescribed species have been observed to attack it.

Boll weevil life history in connection with essential methods of control, C. E. SANBORN (*Oklahoma Sta. Circ.* 50 [1922], pp. 2).—This is a brief summary of information.

Weevils in beans and peas, E. A. BACK (*U. S. Dept. Agr., Farmers' Bul.* 1275 (1922), pp. 35, figs. 29).—This is a summary of information on the approved methods of prevention and control of the weevils attacking peas and beans.

Report of the State apiarist for the years ending October 31, 1919, December 31, 1920, and December 31, 1921, F. B. PADDOCK ET AL. (*Iowa State Apiarist Rpts.*, 1919, pp. 69, figs. 6; 1920, pp. 35; 1921, pp. 88, figs. 15).—These annual reports of the Iowa State apiarist include reports of the proceedings of the annual conventions of the Iowa Beekeepers' Association. Among the papers presented are A Few Iowa Honey Plants of the Rose Family, by L. H. Pammel, in the report for 1919 (pp. 56-60), and Life History Cycle of the Honey Bee, by R. L. Parker, in the report for 1921 (pp. 43-49).

On the structure of the alimentary canal and its ferments in the bee (*Apis mellifera* L.), E. N. PAVLOVSKY and E. J. ZABIN (*Quart. Jour. Micros. Sci.* [London], n. ser., 66 (1922), No. 263, pp. 509-556, pls. 3, figs. 3).—In this report of studies by the authors in Russia, the first part (pp. 510-517) is devoted to anatomy, the second part (pp. 517-543) to physiology. The qualitative determination of the ferments in the different portions of the ventriculo-intestinal tract of the bee was the primary aim of the present work, a study of the ferments of the salivary glands being omitted. In the intestine were established catalase, inulase, lactase, invertase, lipase, pepsin, trypsin, chymosin, and emulsin, of which catalase and invertase were investigated in fuller detail. A list is given of 34 references to the literature.

Studies on chalcid flies of the subfamily Leucospidinae, with descriptions of new species, C. J. WELD (*U. S. Natl. Mus. Proc.*, 61 (1922), Art. 6, pp. 43, pls. 4, figs. 2).—Of the 14 new species here described, 1 is from the United States, namely *Leucospis sloossonae*, which occurs in seven localities in Florida and at Tifton, Ga.

An undescribed planidium of Perilampus from Conocephalus (Hym.), N. FORD (*Canad. Ent.*, 54 (1922), No. 9, pp. 199–204, fig. 1).—The author first reviews the history of the discovery of this stage of the life history of certain chalcidoid genera, then reports upon observations of planidia within the bodies of *Conocephalus fasciatus* De G., one of the small green grasshoppers. Out of nine grasshoppers collected in the Muskoka district at Port Sydney, Ont., in September, 1921, six were parasitized.

Insect parasite introduction in Porto Rico, G. N. WOLCOTT (*Jour. Dept. Agr. and Labor Porto Rico*, 6 (1922), No. 1, pp. 5–20, figs. 7).—The introduction of parasites to combat white grubs in Porto Rico as attempted from time to time is reviewed by the author at some length.

Natural enemies of sugar cane beetles in Queensland, J. F. ILLINGWORTH (*Queensland Bur. Sugar Expt. Stas., Div. Ent. Bul.* 13 (1921), pp. 47, pls. 8).—This is a summary of information on the natural enemies of sugar cane beetles, with a report of studies of their parasites (pp. 23–43). An annotated bibliography of 48 titles is included.

FOODS—HUMAN NUTRITION.

How China uses the soy bean as food, W. H. ADOLPH (*Jour. Home Econ.*, 14 (1922), No. 2, pp. 63–69).—The use of the soy bean is discussed, and analytical data obtained in the author's laboratory are reported.

The article includes descriptive data and analyses of yellow soy beans and their products, including soy bean curd and its ash, soy bean milk, and soy bean sprouts. In his discussion, the author notes that the "Chinese people make practically no use of dairy products, and the bulk of the people consume very meager amounts of meat. Yet in spite of this, they have lived for centuries on what appears to be a remarkably well-balanced diet by the use of the soy bean. It should be pointed out that the soy bean contains little starch, and that from the nutritive standpoint it is not a wheat substitute, but a substitute for meat or milk."

Some observations are recorded regarding the successful use of soy bean curd by dealers in feeding birds, from the time they are hatched until they are able to feed themselves. It is also stated that the true Buddhist monk from birth is consecrated to the priesthood, and is carried through the period of childhood growth on a rather heavy diet of bean curd. The country monastic diet is noted for its high content of soy bean products. Other questions are also considered in the author's discussion.

The use of vegetables in the diabetic diet, H. M. CROLL (*Jour. Amer. Med. Assoc.*, 79 (1922), No. 17, pp. 1424–1426).—A brief review is given of the literature on the treatment of vegetables for use in the diabetic diet and on the resulting composition of the vegetables. A compilation of available data on the carbohydrate content of thrice-boiled vegetables is given in tabular form, and two dietaries for severe diabetes are given to illustrate the variety that can be secured by the use of such vegetables.

Vitamins, J. F. LYMAN (*Ohio Agr. Col. Ext. Bul.*, 18 (1922–23), No. 3, pp. 4, fig. 1).—This is a brief compilation of information on the occurrence and properties of vitamins and estimates on the vitamin requirements of children and adults.

The physiology of creatin and creatinin, A. HUNTER (*Physiol. Rev.*, 2 (1922), No. 4, pp. 586-626).—This extensive review of the literature on creatin and creatinin is treated under the headings of chemical structure and properties, biological distribution, creatinin as a catabolite, metabolic significance of urinary creatinin, origin of creatinin, the influence of muscular work upon creatin-creatinin metabolism, the fate of retained creatin and its bearing on creatin metabolism, creatinuria, and origin of creatin. A list of 218 references to the literature is appended.

Creatinin and creatin in muscle extracts.—III, Concerning the presence of enzymes in muscle tissue which have creatin and creatinin as their substrates, F. S. HAMMETT (*Jour. Biol. Chem.*, 53 (1922), No. 2, pp. 323-337, figs. 2).—In this continuation of the studies on creatinin and creatin previously noted (E. S. R., 46, p. 564), an effort was made to determine whether the conversion of creatin into creatinin in muscle tissue is an enzymatic process. The methods of preparing the extracts and determining creatinin and creatin were the same as in previous studies.

An attempt to separate the accelerating agent from the muscle extracts by dialysis against Tyrode's solution buffered with phosphate mixture showed creatinin and creatin to be easily diffusible. A slightly greater amount of creatinin was present in the extract after 24 hours than in the dialysate, but the difference in amount was considered too small to indicate enzym action. The partial removal of colloids from the extract by centrifugation after 4 hours' incubation retarded to a slight degree creatinin formation. Attempts to destroy the enzyme, if present, by sodium fluorid, mercuric chlorid, and potassium cyanid were unsuccessful.

Studies on the rate of creatinin formation were next made by incubating the extract for from 24 to 30 hours and testing samples at 2-hour intervals. Creatinin determinations showed a more or less periodic rate of creatinin formation. This seemed to be accompanied by changes in the degree of dispersion of the colloids in the extracts. Removal of the colloids by boiling seemed to do away with the abrupt changes in the rate of creatinin formation. Determinations of the velocity constants of the formation of creatinin from creatin in muscle extracts during prolonged incubation at 38° C. showed that the reaction, at least in the later stages, is monomolecular.

The author concludes "that there are no enzymes present in or produced by muscle tissue as such, which form or destroy creatin or creatinin or affect the transformation of creatin to creatinin." The formation of creatinin from creatin is, however, considered to be a reaction of biocatalysis, this being defined as "the nonenzymatic catalysis of a reaction by the milieu afforded by living tissue, in which the soluble organic and inorganic constituents and the state of the colloid material play the significant rôle. It is possible that some of what has been hitherto designated as enzyme activity may be found on closer analysis to be biocatalysis."

The distribution of sodium, potassium, calcium, and magnesium between the corpuscles and serum of human blood, B. KRAMER and F. F. TISDALL (*Jour. Biol. Chem.*, 53 (1922), No. 2, pp. 241-252).—The relative distribution of sodium, potassium, calcium, and magnesium between the corpuscles and serum of human blood has been calculated from determinations of the concentration of these elements in whole blood and blood serum by methods previously noted (E. S. R., 46, p. 416), and of the percentage of corpuscles in the blood by the use of hematocrit.

The data presented show that the corpuscles contain practically no sodium or calcium, a small amount of magnesium, and about 20 times as much potassium as is present in the serum. Evidence is also presented "showing that

there is an excess of about 16 per cent of basic radicles over the well-known acid radicles in both serum and corpuscles. It is likely that the excess is in combination with proteins."

Height and weight as an index of nutrition, [J. C. GEBHART ET AL.] (*New York: N. Y. Assoc. Improving Condition of Poor*, 1922, pp. [16]).—This report of the committee on statistics of the New York Nutrition Council gives a brief survey of present methods of utilizing height and weight measurements as an index of the nutritional status of growth, with a discussion of the difficulties involved in determining from present standards the normal rate of growth of any particular child and concrete suggestions for meeting some of these difficulties. Definite instructions embodying the various points brought out in the discussion are appended for the use of field workers. Among the suggestions made, the following are of particular interest:

In the selection of children for nutritional care, a distinction should be made between defective nutrition and physical retardation. "To determine physical retardation it is necessary first to relate the child's height and weight status to a norm drawn from a social and racial group comparable to that to which the child belongs." The diagnosis of defective nutrition should be based on "such factors as the amount of subcutaneous fat, color of mucous membranes, luster of eyes, general musculature, etc." It is emphasized that the selection of children for nutritional care solely on the basis of height and weight sorts out only roughly the children in need of care and, that while gain in weight is a significant index of nutrition, consideration must also be given to other factors.

In computing expected monthly gains in weight, account should be taken of the seasonal fluctuations in gain in weight. Repeated weighings of a large number of children from 2 to 14 years of age have shown that regularly the greatest gains are made during August to November, inclusive, averaging for the boys 55.3 and for the girls 59.8 per cent of the total gains of the year. Tables calculated by J. C. Gebhart from the results of this study are given, showing the gain in weight in each calendar month expressed as percentage of the annual gain for boys and girls of all ages from 2 to 12, and also the expected gains in pounds by calendar months yearly from 1 to 16 years of age.

Gastric findings in children with anorexia, L. W. SAUER, L. D. MINSK, and W. G. ALEXANDER (*Jour. Amer. Med. Assoc.*, 79 (1922), No. 3, pp. 184-187).—Observations by means of serial roentgenograms are reported on the emptying time of the stomach following a standard test meal in two groups of children, one consisting of 12 normal children with good appetite and the other of 21 underweight children with poor appetite. The observations were repeated in a number of subjects of both groups after a few days and in most subjects of both groups after several months. Determinations of total and free hydrochloric acid were also made of the mixed, unfiltered gastric contents of the same subjects after a test breakfast of arrowroot crackers, water, and sugar.

The average emptying time of the stomach for the group of children with good appetite was 4.5 hours and that of the group with poor appetite 6.1 hours. The stomachs of all the children in the first group were empty in 5 hours, while 16 of the 21 in the second group were not empty at the end of this time. Both total and free hydrochloric acid were higher for the group of children with good appetite than for those with poor appetite. In the later observations several of the children in the second group had improved in appetite and weight, and the emptying time of the stomach was shorter than in the previous test.

Occurrence of anemia in rats on deficient diets, W. M. HAPP (*Bul. Johns Hopkins Hosp.*, 33 (1922), No. 375, pp. 163-172, pls. 2).—On account of the fre-

quency of anemia in infants with rickets, a study has been made of the blood of rats rendered rachitic through faulty diets in the series of studies reported by McCollum et al. The technique of the blood examination is given in full, together with descriptions of the various diets used and the general condition of the animals on autopsy. The diets included, in addition to complex mixtures of various foodstuffs, simple diets in which milk in one form or another was the principal constituent. For purposes of comparison, blood counts were also made on normal rats of different ages. From the results reported, the following conclusions are drawn:

"Well-balanced diets, deficient in iron, do not produce anemia in the rat in the first generation, nor do diets consisting solely of cow's milk or milk and bread. Slight anemia may occur in rats of the second generation on these diets.

"Diets deficient in fat-soluble A or water-soluble B, although they cause severe nutritional disturbances, do not produce anemia in the rat. Diets so deficient in water-soluble B as to produce polyneuritis diminish leucopoietic activity, and cause a severe leucopenia with a shift to the right in the Arneht formula.

"Diets low in an organic substance contained especially in cod liver oil, with a low calcium but high phosphorus content, which produces rickets-like changes in the rat, may also produce anemia, provided the animal is kept for a long period on the diet. Animals of the second generation on this diet may also become anemic. This anemia is associated with evidences of increased hemato-poietic activity. There is often an enlargement of the spleen. This condition resembles the anemias seen in association with rickets in human beings.

"A diet low in the organic substance contained in cod liver oil and low in phosphorus with a normal calcium content, a diet that produces severe rickets with great uniformity, does not produce anemia."

Studies on the intestinal flora of polyneuritic pigeons and the synthesis of antineuritic vitamin by intestinal bacteria. A. SCHEUNERT and M. SCHIERLICH (*Centbl. Bakt. [etc.]*, 1. Abt., Orig., 88 (1922), No. 4, pp. 290-298).—The authors report a bacteriological study of the intestinal flora of normal and of polyneuritic pigeons and an investigation of the effect on polyneuritic pigeons of feeding cultures of bacteria found in the intestines of normal pigeons.

Rice feeding was found to cause a decrease in the intestinal flora varying with the previous treatment of the rice fed. Supplementing the rice feeding with yeast caused lactic acid bacteria and micrococci to predominate, thus bringing about a return to normal conditions. In the second part of the study pigeons were fed rice with bouillon cultures of bacteria found in the normally fed pigeons and of *Micrococcus sulfureus*, *M. candidans*, and *Bacterium acidilactici* isolated from the intestinal contents of a pigeon fed rice and yeast. Through feeding of cultures of *M. candidans* and *B. acidilactici* the progress of polyneuritis was checked, while cultures of *M. sulfureus* and mixed cultures from normal pigeon feces had no effect. It is concluded that certain types of bacteria have the property of synthesizing antineuritic vitamin when grown on vitamin-free bouillon.

Experimental rickets in rats, IV, V. A. M. PAPPENHEIMER, G. F. McCANN and T. F. ZUCKER (*Jour. Expt. Med.*, 35 (1922), No. 4, pp. 421-466, pls. 9, fig. 1).—In continuation of the series of studies on experimental rickets in rats (E. S. R., 47, p. 66), two papers are presented which give a detailed report of an investigation which has been noted in part from a preliminary report (E. S. R., 46, p. 473).

IV. The effect of varying the inorganic constituents of a rickets-producing diet (pp. 421-446).—In this study, in which the authors have had the collabora-

tion of M. Stanley-Brown, M. Strauss, B. Stimson, and E. Klein, the basal diet used in the first study of the series was modified by various alterations in the salt constituents to determine the effects on the bones of rats of replacing potassium by sodium in the secondary phosphate used, of varying the amount of phosphate and the proportion of calcium to phosphorus, and of modifying the other inorganic constituents. The methods employed for diagnosing rickets were the same as in the earlier studies of the series.

The main facts brought out in this study are that lesions in the bones identical with those of rickets are unfailingly produced in rats by a diet adequate in calcium but deficient in phosphorus, the border line being in the neighborhood of 50 mg. of added phosphorus per day. Neither the potassium nor any other inorganic ions confer any protection in the presence of a deficiency of phosphate ion. It is also shown that lesions resembling rickets may result from the administration of a diet deficient in calcium but containing an adequate or excessive amount of phosphate, and that lesions differing from typical rickets in degree rather than in kind may be induced by a deficiency in both calcium and phosphorus.

V. The effect of varying the organic constituents of a rickets-producing diet (pp. 447-466).—In this study the authors, with the collaboration of S. M. Seidlin, J. V. Lichtenstein, and M. Stanley-Brown, have attempted to determine whether organic phosphorus is of equal value with inorganic for bone formation, whether vitamins A and B exert any curative effect on rickets apart from the phosphorus content of the substances in which they occur, and whether it is possible so to alter the basal rickets-producing diet previously employed (E. S. R., 45, p. 767) as to make it more nearly adequate for growth and nutrition without impairing its rickets-producing effect.

Casein given in amounts furnishing the same amount of phosphorus as had been proved adequate in the case of basic potassium phosphate did not give complete protection against rickets, but phosphorus given in the form of lecithin afforded protection equal to that of the inorganic phosphate.

Fresh butter given as a supplement to the basal diet to the extent of 0.4 gm. per rat per day failed to prevent the onset of rickets. It is also noted that eye lesions characteristic of lack of vitamin A occurred in over 90 per cent of the rats on the various modifications of the diets used in this and the preceding study, irrespective of the presence or absence of rachitic lesions. This is thought to furnish convincing evidence that fat-soluble vitamin, as usually defined, plays no part in the pathogenesis of rat rickets. The substitution of 10 per cent of egg albumin for an equivalent amount of patent flour in the standard rickets-producing diet improved the nutrition, but did not prevent rickets. The addition of meat to the diet supplied sufficient phosphorus to promote normal growth and bone formation. The diet finally selected as giving a growth curve approximating normal, but producing rickets with regularity, consists of patent flour 80.9, egg albumin 10, butter fat 5, and salt mixture 4.1 per cent. The salt mixture, which is based on the analyses of the milk of small animals instead of cow's milk, contains in 100 gm. of the diet the following salts: KCl 0.85, Na_2CO_3 0.85, MgCO_3 0.286, Ca lactate 2.0, ferric citrate 0.1 KI 0.0002, MnSO_4 0.00078, NaF 0.0024, and $\text{KAl}(\text{SO}_4)_2$ 0.00024 gm.

Both papers are abundantly illustrated with radiographs of the bone lesions produced by various diets.

Experimental rickets in rats.—VI, The anatomical changes which accompany healing of experimental rat rickets, under the influence of cod liver oil or its active derivatives, A. M. PAPPENHEIMER (*Jour. Expt. Med.*, 36 (1922), No. 3, pp. 335-355, pls. 9).—Continuing the series of studies noted

above, the author describes in detail, with illustrative plates, the various changes occurring during the healing of the bone lesions in rickets following the administration of cod liver oil or one of the active fractions prepared from it by methods noted in a preliminary report (E. S. R., 47, p. 369). For purposes of comparison, descriptions are also given of the appearances of the ribs of normal animals on a complete diet of nonrachitic rats which because of an inadequate diet have failed to grow normally, and of rats on the standard rickets-producing diet used in previous studies.

The first obvious effect of the administration of cod liver oil was the deposit of calcium salts in the zone of preparatory calcification. The subsequent changes were no different in principle from those that take place in normal bone growth, and corresponded closely to those found in the healing of human rickets.

Experimental rickets in rats.—VII, The prevention of rickets by sunlight, by the rays of the mercury vapor lamp, and by the carbon arc lamp, A. F. HESS, L. J. UNGER, and A. M. PAIPPENHEIMER (*Jour. Expt. Med.*, 36 (1922), No. 4, pp. 427-446, pl. 1).—In this and the following paper are summarized, with experimental data, results obtained in the study of the effect of sunlight and light rays of different kinds on the experimental rickets of rats.

The effect of sunlight, as previously noted (E. S. R., 47, p. 66), in daily exposures of 15 minutes was equivalent to about doubling the protective dose of phosphorus. The same degree of protection could not be obtained during November and December as earlier in the year. This is attributed to the lack of ultraviolet radiation in that season of the year. The potency of the sunlight was destroyed by passage through window glass, and was decreased by reflection from a smooth white surface.

The rays of the mercury vapor quartz lamp were sufficient to protect rats against rickets on a diet low in phosphorus when the rays were produced by an alternating current of 160 volts and the exposure was for 3 minutes or less at a distance of 3 ft. Attempts to protect rats from rickets by irradiation before they were placed on the experimental diet were unsuccessful, thus suggesting that the treatment did not enable the animals to store or synthesize any protective substance in their tissues.

In experiments with a carbon arc lamp, daily exposures of 3 minutes at a distance of 3 ft. regularly prevented the occurrence of rickets. The protective effect of the carbon arc light was also tested on rats fed more complex diets. Protection was secured against rickets when the diet was characterized either by a low phosphorus and high calcium content or by high phosphorus and low calcium content. Moderate variations in temperature did not alter the effective action of the rays.

Experimental rickets in rats.—VIII, The effect of Roentgen rays, A. F. HESS, L. J. UNGER, and J. M. STEINER (*Jour. Expt. Med.*, 36 (1922), No. 4, pp. 447-452, pls. 2).—This paper reports experimental evidence leading to the conclusion previously reported (E. S. R., 48, p. 66) that rats on a low phosphorus diet can not be protected against rickets by exposures to small doses of Roentgen rays, and that rats on a diet containing sufficient phosphate to prevent rickets are not rendered rachitic by exposure to doses of Roentgen rays of sufficient intensity to produce marked destruction of the blood-forming cells of the marrow.

Food poisoning investigations; Bacillus botulinus conquered (*Canner*, 55 (1922), No. 17, pp. 26-31).—In this report by H. Burden, chairman of the committee on scientific research of the National Canners' Association, a brief

history is given of the food poisoning investigations which have been conducted under the auspices of the association during the past five years. The committee report also gives a summary of the recommendations made to canning plants by the association with reference to the prevention and control of contamination of canned goods by *B. botulinus* and its toxin. The recommendations are summarized under the headings of sanitation, processing, coding, incubation, and storage.

ANIMAL PRODUCTION.

The influence of alcohol on the fertility of white rats, E. C. MACDOWELL (*Genetics*, 7 (1922), No. 2, pp. 117-141, figs. 7).—To study the effect of alcohol fumes on the fertility of rats, data are given comparing the number of rats per litter and the number of litters produced by treated and untreated rats from treated and untreated parents and by untreated rats from untreated parents with treated and untreated grandparents. In most cases the comparative pairs were closely related. The method of treatment with alcohol was similar to that employed in previous work (E. S. R., 47, p. 278). The following table gives the data which were obtained on the comparative size of litters and number of litters produced:

Summary of the influence of alcohol on the fertility of rats.

Tests with pairs of—	Controls				Tests.				Percentage difference between number of litters produced and number expected.
	Pairs.	Litters.	Rats per litter.	Litters per pair.	Pairs.	Litters.	Rats per litter.	Litters per pair.	
Untreated and treated rats from untreated parents.....	42	87	6.7	2.07	44	32	6.03	0.72	-64.86±3.37
Untreated and treated rats from treated parents.....	12	29	6.58	2.41	9	14	5.92	1.55	-35.45±6.91
Untreated rats from untreated and treated parents.....	10	15	6.20	1.50	10	20	5.50	2.00	+33.33±8.29
Untreated rats from untreated parents with untreated and treated grandparents.....	13	19	6.68	1.46	11	25	5.80	2.27	+55.60±8.40

The table indicates that the alcohol has reduced the size of the litters by about 10 per cent, though different strains give variable results. The number of litters have been reduced where the rats were treated, but where the parents or grandparents were treated more litters were produced. The author states that in so far as the results show a reduction in the total number of young produced due to alcohol, they agree with the results previously noted by Stockard and Papanicolaou (E. S. R., 41, p. 863) and Pearl (E. S. R., 39, p. 177).

Experiments with alcohol and white rats, E. C. MACDOWELL (*Amer. Nat.*, 56 (1922), No. 645, pp. 289-311, figs. 5).—This is a summary of the results of work which has been carried on at Cold Spring Harbor, Long Island, N. Y., in treating white rats with alcohol fumes, parts of which are reported above. In addition, results are given showing the effect of alcohol on the weights of male rats grouped as in the table above. The table following shows the percentage difference in weight, with probable error, of the treated and control male rats at different ages.

Difference in weight of control male rats as compared with treated rats of different ages.

Kind of rat.	Weights at different ages.					
	40 days	60 days.	90 days.	120 days	150 days.	180 days
Treated from untreated parents..	Grams. +2.52±1.40	Grams. +12.69±2.16	Grams. +27.00±3.16	Grams. +37.61±4.07	Grams. +42.58±4.81	Grams. +38.46±5.11
Treated from treated parents.....	-2.05±2.73	+3.81±3.81	-0.13±4.96	+9.43±6.01	+8.17±6.48	+12.30±7.44
Untreated from treated parents.....	-9.21±2.37	-11.40±2.56	-9.47±3.64	-13.12±5.13	-10.54±6.24	-10.15±7.61
Untreated from untreated parents, and treated grandparents	+1.67±5.08	-13.98±5.36	-5.64±11.4	-20.33±16.66	-18.09±16.20	-5.34±13.52

The conclusions which the author has drawn from the entire work are that treated rats, and untreated rats whose grandparents were treated, took more time in running the maze, that all rats treated or descendants of treated rats to the second generation produced smaller litters, and that treated rats descended from both treated and untreated parents produced fewer litters and grew more slowly, whereas untreated rats descended from treated parents or grandparents only produced more litters and were heavier in weight than the controls.

"The data on behavior and litter size suggest that the alcohol may modify germinal material directly. The data on the number of litters and growth indicate that the direct effect of alcohol upon these characters is in one direction, and that its indirect effect is in the opposite direction. This may be interpreted by the assumption of a selective rôle played by the alcohol."

Variations in the number of vertebrae and other meristic characters of fishes correlated with the temperature of water during development, C. L. HUBBS (*Amer. Nat.*, 56 (1922), No. 645, pp. 360-372, figs. 7).—The author has collected specimens of shiners (*Notropis atherinoides*) and bluegill sunfish (*Lepomis incisor*) from a lagoon off of Lake Michigan. These were hatched during 1918 and 1919, and showed significant differences in the number of vertebrae, number of scales along the lateral line, and number of branched anal rays for the fish hatched in the different years. These differences are attributed to differences in the temperature of the water at the time of development during those years.

On the influence of density of population upon the rate of reproduction in *Drosophila*, R. PEARL and S. L. PARKER (*Natl. Acad. Sci. Proc.*, 8 (1922), No. 7, pp. 212-219, fig. 1).—The authors describe experiments carried on at Johns Hopkins University in which from 1 to 50 pairs of *Drosophila* were put in half pint bottles and the number of offspring produced in 16 days were recorded.

It was found that the number of offspring produced per mated female per day was much larger in the sparsely populated bottles and vice versa. The number of offspring in any population could be very closely calculated by the equation,

$$\log y = 1.54 - 0.008x - 0.658 \log x.$$

In this y equals the number of offspring produced per mated female per day, and x denotes the mean density of the mated population.

The effect of selection for eye facet number in the white bar-eye race of *Drosophila melanogaster*, C. ZELENY (*Genetics*, 7 (1922), No. 1, pp. 115, pl. 1, figs. 125).—Studies at the University of Illinois on the effect of selection for

low and high eye facet number in *Drosophila* during 42 generations have shown that except for the occurrence of mutations to ultra-bar or full eye¹ the selection caused a marked decrease or increase in eye facet number during the first few generations. In the succeeding generations there was a little progress made by selection, which was brought about by the elimination of individuals with lower facet numbers in the high line and the elimination of individuals with higher facet numbers in the low line, with a consequent reduction in the variation which occurred.

The general plan of the experiment was to mate the male having the lowest (or highest) eye facet number with a similar female in the low (or high) strain in each generation. A constant temperature of 27° C. (80.6° F.) was maintained at all times for the flies, due to the dependence of facet number on temperature as previously demonstrated by J. Krafka, jr.² The variations in facet number were studied by the method of factorial values previously noted (E. S. R., 43, p. 668). The appearance of a sex-linked lethal factor causing an increase in the facet number produced some unexpected variation between the males and females in the high line from the twenty-first to the twenty-eighth generation. The general results of the work demonstrate the existence of definite hereditary factors for facet number which were largely sorted out by the process of selection in from one to five generations.

Mendelism in fur sheep crosses.—II, The zygotic cause of red lambs when fur sheep are crossed on longwools or their grade offspring, R. W. DUCK (*Jour. Heredity*, 13 (1922), No. 2, pp. 63-68, figs. 4).—In continuation of the studies of coat color in Karakul sheep previously noted (E. S. R., 47, p. 670), the author explains the occurrence of red lambs as due to a factor which is recessive to black but dominant to white. Red lambs could then only come from matings of black ewes and rams when both parents are heterozygous or from matings of heterozygous black rams and white ewes.

The vitamin hypothesis and its practical significance in stock feeding, J. B. ORR (*Highland and Agr. Soc. Scot. Trans.*, 5. ser., 34 (1922), pp. 52-67).—This is a discussion of the effects of a lack of vitamins on growth, with special regard to the doubtful applicability of the results obtained on small animals to horses, cattle, sheep, and swine, as well as a review of the vitamin studies which have been made with the larger animals.

[Composition of] silage (*Canada Expt. Farms, Div. Chem. Interim Rpt.*, 1921, pp. 34-39).—The composition of samples of silage made from clover; oats, vetch, and rye; oats and vetch; oats, wheat, pea, and vetch; Japanese millet; corn; and sunflower taken from different portions of silos and cut at different stages of growth is reported.

Feeding stuffs (*Canada Expt. Farms, Div. Chem. Interim Rpt.*, 1921, pp. 40-54).—Analyses of the following feeding stuffs submitted by farmers are reported: Wheat bran, wheat middlings, barley flour, oat flour, corn flour, linseed meal, cottonseed meal, fish meal, semisolid buttermilk, flax bran, flaxseed, barley hay, peanut kernels, peanut skins, and pea bran, as well as proprietary stock and poultry feeds.

Production of starch on a small commercial scale from root crops and corn [and the feeding value of the residue], F. G. KRAUSS (*Hawaii Sta. Rpt.*, 1921, pp. 55-57).—Feeding tests were carried on with swine and poultry at the Haiku Substation using the residue from the manufacture of starch, as practiced on a small scale, from edible canna, sweet potatoes, taro, corn, and

¹ *Jour. Expt. Zool.*, 34 (1921), No. 2, pp. 203-233.

² *Jour. Gen. Physiol.*, 2 (1920), No. 4, pp. 409-432.

cassava. Corn was found to be a failure as a source of starch, but about 20 per cent of the weight of the roots was recovered as air-dried starch. The residues from cassava and sweet potatoes were found to be equal in feeding value to corn, pound for pound, on a water-free basis when not exceeding 50 per cent of the total ration fed.

Mature hogs and pigs made average daily gains of from 0.75 to 1.75 lbs. per day on such rations. The cassava, sweet potato, and taro residues were very palatable to hogs, either raw or cooked, but edible canna and Irish potato residues were eaten only when cooked. Poultry ate only limited amounts of the residues if other feeds were available.

The cost of manufacture of the starch is tabulated, showing the profits which result. It is thought that the returns from the residue when fed to hogs would cover the cost of manufacturing the starch from the roots.

Feeding beans from Brazil, Goy (*Mitt. Deut. Landw. Gesell.*, 36 (1921), No. 46, pp. 661, 662).—A discussion is given of the feeding of beans imported into Germany from Brazil. These are varieties of *Phaseolus vulgaris* and are described as being of two types, one a small, flat, cocoa-colored bean, and the other a larger, reddish brown, partially spotted bean which is also called the Dutch bean. Horses and hogs are reported as not eating the beans well, and in some cases where they did eat them the animals suffered from diarrhea and loss of flesh. Cattle, however, seemed to do fairly well on the beans and seemed to like them. Chemical analyses for hydrocyanic acid were negative. The average composition from several analyses of the Brazilian beans is reported as follows: Water, 10.89 per cent; protein, 21.23; fat, 1.86; nitrogen-free extract, 54.92; and ash, 4.16 per cent.

Live stock on the sugar plantation, J. R. QUESENBERRY (*La. Planter*, 69 (1922), No. 4, pp. 59-61).—To demonstrate the possibilities of live stock on the black, stiff lands of the cane belt, a series of tests were carried on at the Iberia Live Stock Experiment Farm in Louisiana.

In an experiment to determine the cost of growing and finishing steers from birth to marketable age, it was found that the feed required for the maintenance of a cow for one year averaged 1,914 lbs. of silage, 92 lbs. of grain, and 339 days of pasture, allowing 2½ acres per cow. The cost of these materials plus 25 per cent (since an average calf crop was 80 per cent) was considered as the cost of raising a calf to weaning age. From weaning to the time when the calf entered the feed lot at 1 year 9 months of age, it consumed 168 lbs. of grain, 1,742 lbs. of silage, and 363 days of pasture. In finishing a steer it required 5,040 lbs. of corn and soy bean silage, 608 lbs. of cottonseed meal, and 608 lbs. of molasses, the calculated cost of feed per steer being \$30.04 to 1 year 9 months of age and \$26.78 for finishing, after which the steers averaged 1,100 lbs.

A lot of Texas steers fed in comparison with the above native steers did not make as good gains, although they consumed practically the same amount of feed, being fed at a loss.

Eight lots of nine 700-lb steers each were fed on the following rations to determine the efficiency of these feeds for beef cattle: Lot 1, corn silage; lot 2, corn silage and rice bran; lots 3 and 4, corn silage; lot 5, corn and Biloxi soy bean silage; lot 6, sorghum silage; lot 7, sorghum and Biloxi soy bean silage; and lot 8, Japanese cane and Biloxi soy bean silage. All lots received in addition cottonseed meal and molasses, except in case of lots 1 and 2 which received no molasses. The feeding of lots 3 and 4 differed in that

more molasses were fed in lot 4. The following table summarizes the results of the test:

Feeds consumed and gains made by steers on comparative rations.

Lot.	Average final weight.	Average daily gain.	Feed consumed per 100 lbs. of gain.			
			Silage.	Cotton-seed meal.	Rice bran.	Molasses.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1.....	941.44	2.09	2,250.43	258.77		
2.....	928.75	1.98	2,380.15	141.20	141.20	
3.....	984.11	2.48	1,880.16	218.23		218.23
4.....	977.22	2.41	1,922.54	225.15		335.42
5.....	951.11	2.16	2,088.15	250.69		250.69
6.....	917.78	1.91	2,232.97	283.93		283.93
7.....	905.56	1.81	2,454.68	298.85		298.85
8.....	919.22	1.91	2,288.21	283.49		283.49

A series of hog feeding tests was also carried out at this farm. Two lots of 12 pigs were fed rice polish and tankage, one lot being fed in a self-feeder and the other lot having the amounts limited to one-half those consumed by the self-feeder lot. Both lots were on oat pasture. The self-fed lot reached 211 lbs. in 84 days, consuming 317.53 lbs. of rice polish and 20.12 lbs. of tankage per 100 lbs. of gain. After 105 days on the limited feeding, it took this lot 31 days on the self-feeder to reach 211 lbs. in weight, with the consumption of 367.34 lbs. of rice polish and 24.80 lbs. of tankage per 100 lbs. of gain.

Two lots of pigs self-fed rice polish and tankage, one on oat pasture and the other in dry lot, made respective daily gains per head of 1.47 lbs. and 1.45 lbs., with a feed requirement per 100 lbs. of gain of 328.12 and 358.85 lbs. of rice polish and 19.79 and 40.03 lbs. of tankage, respectively.

Seven lots of pigs were self-fed the following grain rations with oat pasture and tankage self-fed in all lots and with 3.14 lbs. of skim milk per pig daily in lots 1, 2, 3, and 4; Lots 1 and 5, corn; lots 2 and 6, rice brewers' grains; lots 3 and 7, rice polish; and lot 4, rice polish with all the blackstrap molasses the hogs would clean up daily. The following table gives a summary of the gains made by the different lots, showing the amount of feed consumed per 100 lbs. of gain and the calculated cost of the feeds.

Economy of gains made by hogs on the comparative rations with oat pasture.

Lot.	Length of test.	Average final weight.	Average daily gain.	Feed consumed per 100 lbs. gain.						Feed cost per 100 lbs. gain.
				Shelled corn.	Rice brewers' grains.	Rice polish.	Tankage.	Skim milk.	Molasses.	
	Days.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	
1.....	84	207.25	1.77	364.09			6.57	177.5		\$6.33
2.....	84	234.58	2.07		333.22		3.97	151.41		4.88
3.....	84	190.83	1.57			308.76	12.10	199.35		4.19
4.....	84	211.25	1.80			290.23	6.07	174.59	59.94	3.95
5.....	105	255.25	1.83	382.08			12.87			6.05
6.....	105	248.36	1.73		397.63		13.03			5.30
7.....	105	249.33	1.74			328.12	19.79			4.77

Kentucky steer feeding results, L. J. HORLACHER (*Breeder's Gaz.*, 82 (1922), No. 11, pp. 302, 303).—To determine the effect of changing the feed of

fattening steers, two lots of 10 steers each were fed at the Kentucky Station for 118 days, the one lot receiving shelled corn, cottonseed meal, corn silage, and straw during the entire period, whereas the other lot received this ration for the first 76 days, after which clover hay was gradually substituted for corn silage until the eighty-sixth day, when the substitution was complete, after which the clover hay was continued to the end of the experiment.

During the 10 days of changing the silage to clover there was an average loss of 24.5 lbs. per steer which was never regained by that lot. The average daily gain per steer for the entire test on the changed ration was 2.57 lbs., as compared with 2.72 lbs. for the steers kept on the same ration for the 118 days. In both lots during the first 76 days the corn fed was limited, but as much of the silage was fed as the animals would eat. After the seventy-seventh day, however, the amount of corn was rapidly increased.

Feeding steers having access to barn and range v. steers confined to barn. E. S. GOOD (*Kentucky Sta. Bul.* 242 (1922), pp. 115-135, figs. 7).—This is a more detailed report of the 3-year steer feeding tests previously noted (E. S. R., 43, p. 373) in which 2 lots of about 10 steers each were fattened from 140 to 161 days during the winter. Both lots received the same feeds each year, but one lot was confined to the barn and a small covered yard, whereas the other lot had the run of a 20-acre pasture in addition. The feeds during the first year consisted of cottonseed meal, shelled corn, sorghum silage, corn stover, and oat straw, during the second year of cottonseed meal, sorghum silage, blue grass chaff, and wheat straw, and during the third year the same feeds were used as in the first year except that wheat and soy bean straw replaced the oat straw. Each year the 2 lots consumed nearly equal amounts of feed.

The average daily gains made by steers with range and those confined during the different years were, respectively, 1.82 and 2.07, 1.2 and 1.35, and 1.67 and 1.77 lbs. The confined steers also made their gains each year at a lower feed cost, including pasture, and the finish of these steers was better during two of the years and equivalent during the other year to the finish of those which received pasture. Another consideration in favor of the confined steers was that more manure was recovered in the barn.

Steer feeding [at the Michigan Experiment Station]. W. E. J. EDWARDS (*Michigan Sta. Quart. Bul.*, 5 (1922), No. 2, pp. 51-53, fig. 1).—This is a discussion of steer feeding in which corn silage, clover or alfalfa hay, and linseed or cottonseed meal are recommended. Steers fed an average of 52 lbs. of corn silage, 3.93 lbs. of clover hay, and 1.96 lbs. of linseed meal made daily gains per head of 2.6 lbs. for 59 days. Continuing these steers for 84 days on this ration with the addition of 9.5 lbs. of shelled corn and increasing the linseed meal to 2.25 lbs., with a reduction in the silage, average daily gains of 2.23 lbs. were made.

Cattle stock and fodder famines in Hissar. R. BRANFORD (*Agr. Jour. India*, 17 (1922), No. 3, pp. 242-250).—This is a discussion of the plants which are available for grazing during periods of drought in the vicinity of the Government Cattle Farm at Hissar, India.

Breeding experiments with Kentucky mountain ewes. L. J. HORLACHER and E. S. GOOD (*Kentucky Sta. Bul.* 243 (1922), pp. 139-199, figs. 69).—This is a complete report of the experiment previously noted (E. S. R., 48, p. 170). The Rambouillet crosses showed Rambouillet characteristics in body form and covering of wool. The lambs were vigorous and hardy and made rapid gains. The ewes possessed the desirable milking and mothering qualities of the mountain ewes to a greater extent than any of the other crosses. The smallest proportion of twins were produced in the Rambouillet crosses and the largest proportion in the Hampshire crosses. The Hampshire-mountain lambs, how-

ever, lacked uniformity and were somewhat loosely put together, though they made very rapid gains. More satisfactory results were obtained by mating Hampshire lambs with Rambouillet-mountain ewes. The Southdown crosses showed good mutton form and the best quality of any of the lambs, but they were small and slow maturing. The Cheviot crosses showed the most vigor and activity, but they were too much like the mountain ewes in body form.

The crossbred individuals in practically all cases produced more and better quality wool than the mountain sheep, and there was a more even covering of wool over the body. The second and third generation of crosses with purebred rams tended to produce offspring which closely resembled purebreds.

On the quality and inheritance of sheep's wool in purebreds and crosses with special regard to Merinos, W. VOLTZ (*Arb. Deut. Landw. Gesell., No. 315, (1922), pp. 30*).—The quality and fineness of the wool of crosses of different breeds of sheep have been studied by classifying the wool mainly according to the diameter of the fibers. Among the breeds used were Merinos, Oxfordshires, Cotswolds, and the common Pomeranian a medium woolled sheep. The general conclusion was that the crossing of sheep of different wool types produced offspring of mixed wool which was very difficult to get uniform after several generations of breeding.

Loss on scouring of various grades of wool (*Canada Expt. Farms, Div. Chem. Interim Rpt., 1921, pp. 17, 18*).—Determinations made on 102 samples of wool showed that the loss on scouring varied from 27 to 62 per cent based on dry weight.

Swine feeding experiments [at the Morris Substation], P. E. MILLER (*Minnesota Sta., Morris Substa. Rpt. 1921, pp. 39-43*).—A series of feeding tests was carried on in which 5 lots of 10 Duroc pigs each received the following feeds in self-feeders from June 28 to September 23: Lot 1 corn and tankage with rape pasture, lot 2 corn with rape pasture, lot 3 barley and tankage with rape pasture, lot 4 corn and tankage with blue grass pasture, and lot 5 corn and tankage in dry lot. The following table gives a summary of the results of the tests:

Summary of tests of various rations for swine.

Lot.	Average per pig.		Feed consumed per 100 lbs. gain.			Tank-age in ration.	Cost of feed per 100 lbs. gain. ¹	Profit per 100 lbs. pork. ²
	Initial weight.	Daily gain.	Corn.	Barley.	Tank-age.			
	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Per cent.		
1.....	50.06	1.31	300	.....	33	10.01	\$4.17	\$2.83
2.....	51.58	.52	478	.....	.....	.....	4.78	2.22
3.....	51.36	1.23	.....	364	47	11.40	5.29	1.71
4.....	52.20	1.38	281	.....	41	12.70	4.24	2.75
5.....	50.68	1.24	277	.....	61	21.80	4.80	2.13

¹ Tankage, \$70 per ton; corn, 56 cts. per bushel; and barley, 48 cts. per bushel.

² Pork at \$7 per 100 pounds.

A study of buttermilk products as supplements to grain and tankage in swine feeding, F. G. HELYAR (*New Jersey Stat. Rpt. 1921, pp. 106-109, pl. 1*).—From June 15 to October 24, 1920, 4 lots of 10 pigs each on pasture received shelled corn, standard wheat middlings, and tankage in a self-feeder, and in addition lot 2 received semisolid buttermilk in amounts equal to 20 per cent of the grain consumed; lot 3 received semisolid buttermilk in amounts equal to 10, 20, 30, and 40 per cent of the grain consumed during the first, second,

third, and fourth 3-week periods of the test, respectively; lot 4 received Milkolene in daily amounts equal to 1 part by volume to 49 parts of water normally required by the pigs. The results of the test are given in the following table:

Summary of pig feeding experiments with buttermilk products.

Lot.	Average initial weight.	Average daily gain	Feed consumed per 100 lbs. gain.				Cost per 100 lbs. gain.
			Corn.	Wheat middlings	Tankage.	Buttermilk.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	
1.....	55.3	1.02	360.6	3.09	21.9	.....	\$12.85
2.....	54.6	1.50	321.7	2.61	17.3	61.30	14.75
3.....	60.4	1.44	321.4	3.60	13.5	83.30	15.73
4.....	65.7	1.23	365.9	7.06	19.1	8.04	14.00

The author concludes that the only possible economy in feeding buttermilk products would be due to the fact that the pigs are ready for market earlier or to assist in giving them a better start while young.

Swine publications and associations, J. M. EYVARD and A. L. ANDERSON (*Iowa Sta. Circ. 79 (1922), pp. 8*).—This circular contains lists of books, bulletins, and periodicals which are of interest to the swine industry, as well as an address list of the swine-breeding associations in the United States.

Poultry, A. W. RICHARDSON (*New York and London: Harper & Bros., 1922, pp [6]+152+XII, pls. 4, figs. 6*).—This is a general handbook for the practical poultry raiser.

[**Poultry work at the New Jersey State Station**], H. R. LEWIS (*New Jersey Stas. Rpt. 1921, pp. 121-123, 126-128, 144-148, pl. 1*).—Five years' experiments dealing with the variation in and inheritance of eggshell color have indicated that there is a tendency toward the inheritance of shell color. By using trap nests hens laying eggs of the desirable color may be selected for breeders and a flock thus established that will have a tendency to lay eggs of the more desirable color.

An experiment, in which 19 different lots of White Leghorns were fed rations containing different amounts of meat scrap with a different relationship existing between the amount of dry mash and scratch grain fed, has led to the conclusions that the ratio between the mash and scratch feed should vary during the year. When egg production is highest the amount of mash should exceed the amount of scratch feed. Mash containing 20 per cent meat scrap was more efficient for egg production than where 30 per cent of meat scrap was included.

Birds receiving artificial illumination in the evening not only produced more eggs during the year, but produced more eggs when prices were highest.

In studying the value of wrapping eggs in different grades of tinfoil to aid in preserving them in storage, it was found that less evaporation occurred with the wrapped eggs as determined by weekly weights, but the wrapped eggs were inclined to mold, due to the accumulation of moisture between the shell and the tinfoil.

Winter egg production, E. C. FOREMAN (*Michigan Sta. Quart. Bul., 5 (1922), No. 2, pp. 55-59, fig. 1*).—This is a description of different methods of artificial lighting for winter egg production. Emphasis is placed on the unsatisfactory results which may occur from too much lighting or improper feeding.

Report of the department of biology [of the New Jersey State Station], T. C. NELSON (*New Jersey Stas. Rpt. 1921, pp. 289-297, pls. 2*).—In this report the conclusion of the study on the rate and extent of growth of adult oysters (E. S. R., 46, p. 576) has shown that during the year the Huey's Creek naturals gained 52.6 per cent in weight, 24.4 per cent in length, and 19.7 per cent in width, whereas the Grassy Channel seed made respective increases of 66.1, 21.7, and 25.8 per cent. Spring and early summer were the seasons of most rapid shell growth, while autumn is the time of shell thickening, body growth, and fattening. Oysters on the bottom, if not imbedded in the mud, made practically the same growth as oysters on a platform.

A study of the food of the oyster is being continued to determine the part played by plankton organisms in the oyster's food supply. It has been determined that there is a critical temperature between 42 and 45° F. above which the oyster feeds freely, but below which the oysters only keep a very feeble current of water passing through the gills for sufficient oxygen for life and a minute amount of food.

A summary of the distribution of oyster larvae by dates in different regions of oyster production is given. Studies of spawning have shown that male and female oysters in the same group will spawn together, and that the eggs are fertilized in a few minutes. The injury to seed oysters, due to the oyster drill, is very serious in some places, and efforts are being made to trap them.

DAIRY FARMING—DAIRYING.

The maintenance requirements of dairy cattle, J. L. HILLS (*Vermont Sta. Bul. 226 (1922), pp. 3-191*).—The results are reported of a series of trials carried on from 1907 to 1920 to determine the maintenance requirements of dry farrow cows, dry pregnant cows, and pregnant and nonpregnant cows while producing milk. The rations fed in these experiments were the same as those fed in the experiment reported in Vermont Station Bulletin 225 (E. S. R., 48, p. 173). The results of 324 records on 61 animals, as reported in that bulletin, are added to the data obtained in this test, which includes the results on 20 cows.

A review of the literature and a discussion of the development and comparative requirements of the different feeding standards for dairy cattle are given, and compared with the result obtained in these experiments. It is the author's belief that the standard for maintenance as recommended by Armsby and Eckles allowing 0.5 lb. digestible true protein and 6 terms energy, provides sufficient digestible protein and total digestible nutrients for the maintenance of a 1,000-lb. dry nonpregnant cow, whereas the Haecker, Savage, modified Wolff-Lehmann, and Woll-Humphrey standards are too liberal. The digestible protein requirements for milk production according to the Haecker, Armsby, and Eckles standards are nearly in accord with the results of this test, but in the Haecker standard the total digestible nutrients allowed is too high and in the Armsby standard the digestible dry matter (calculated) is too low. The Savage standard is too high for both the digestible protein and the total digestible nutrients.

It was found in the tests that practically none of the nonnitrogenous feed was used for fetal development, but a small amount of the digestible protein equivalent to an average of 0.05 to 0.1 lb. daily was found to be taken for this purpose. During the first two-thirds of gestation a ration furnishing standard amounts of nutrients for maintenance and milk production should be ample for fetal development, but during the last third of gestation, though only a small amount of milk is being given, allowance should be made for the nutrition of the fetus over and above requirements for maintenance and milk.

The mineral metabolism of the milch cow, E. B. FORBES, C. H. HUNT, J. A. SCHULZ, A. R. WINTER, and R. F. REMLER (*Ohio Sta. Bul. 363 (1922), pp. 3-59, figs. 3*).—Previously noted (*E. S. R.*, 47, p. 873).

The substitution of urea for protein in the case of wethers and lactating animals, A. MORGEN, G. SCHÖLER, K. WINDHEUSER, and E. OHLMER (*Landw. Vers. Sta.*, 99 (1921), No. 1, pp. 1-26).—This is a report of feeding experiments conducted on wethers and later on milch goats and sheep to determine whether the protein of the feed can be replaced by urea.

A 7-year-old healthy wether weighing 52 kg. was first fed clover hay 100 gm., oat straw 600, sugar 100, blood meal 75, and a salt mixture 10 gm. The salt mixture consisted of 50 per cent calcium phosphate, 25 per cent of the ash of hay, and 25 per cent of common salt. On this feed, which had a starch value of 5.15 kg. with 1.23 kg. of digestible protein per 1,000 kg. of weight, the animal came to nitrogen equilibrium in a short time. The blood meal was then gradually replaced by an amount of urea calculated to furnish the same amount of nitrogen as the digestible protein of the blood meal. This amounted to 18.6 gm. of urea per day substituted for 1.04 kg. of the total protein of the ration, or 68 per cent. This reduced the starch value of the ration to 4.21 kg. and the digestible protein to 0.25 kg. Feces and urine were collected and weighed daily and mixed samples of each analyzed nearly every other day.

The data obtained show that with the beginning of the urea feeding there was a large loss of nitrogen, averaging between 2.75 and 4.33 gm. nitrogen per day. At the end of 8 weeks the amount of urea was increased to 30 gm a day. This was followed by decreased nitrogen elimination and after about 10 days by nitrogen equilibrium. The animal had after 9 weeks lost about 8 kg. in weight, and the experiment was discontinued.

A second wether not quite a year old and weighing 37 kg. was then fed daily clover hay 100 gm., oat straw 600, sugar 100, blood meal 55, and the salt mixture 10 gm., on which ration nitrogen equilibrium was quickly reached. The starch value of this ration per 1,000 kg. weight was 6.89 kg., with 1.37 kg. digestible pure protein. The nitrogen of the digestible protein was then replaced by 13.4 gm. of urea and 56 gm. gelatin in successive periods. Feeding with urea was followed first by a nitrogen loss of about 1.9 gm. per day. This gradually lessened, and equilibrium was reached in 19 days. On replacing the urea by gelatin there was again a loss of nitrogen amounting to about 2.07 gm daily, followed by a period in which equilibrium was nearly reached, and then by a further loss. On going back to urea the loss became less and averaged for 18 days only 0.62 gm. daily.

The authors conclude from these two feeding trials that the individuality and the age of the animal plays a part in the utilization of urea, and that if it is to be used successfully, the protein requirement of the animal should be known so that the allowance of urea can be made adequate.

The next series of experiments dealt with the milk production of goats and sheep when a certain percentage of the protein was replaced by urea, and in a few cases by ammonium acetate. The experiments covered a period of three years in which 15 animals were used, 10 goats and 5 sheep. The feed consisted of clover hay and straw, potato starch, sugar, dried potato pulp, and as protein-containing materials blood meal and cooked soy bean meal. The starch value for the different periods varied from 12.2 to 19 kg. and the protein from 3.01 to 4.01. The rations were adjusted so that the goats gave about 30 and the sheep about 12 kg. of milk per day per 1,000 kg. weight and were purposely low in digestible nitrogen. The periods on each feed lasted from 9 to 15 days. In some cases urea was given in the first period and was followed by the

protein feed and then by another urea period. In the others the order was reversed.

A comparison of the milk, both in quantity and composition, during the urea periods in which an average of about 40 per cent of the protein was substituted by urea, with corresponding values during the protein periods, gave, on calculation of the results of the urea periods as percentages of the values obtained during the protein periods the following average results: Yield of milk 86 per cent, dry matter 89, fat 99, and nitrogen 88 per cent. In two of the series of experiments with goats the percentages of fat in the urea periods were 112 and 102 per cent, respectively. A comparison of the amount of nitrogen available for milk production and the amount actually produced in the blood meal and urea periods gave positive values in all of the protein, and small negative balances in some cases and positive in others in the urea periods. Conflicting results were obtained in determinations of the nitrogen balance.

The general conclusion drawn from this study is that in a ration containing a normal amount of protein, the protein may be substituted by urea to the extent of from 30 to 40 per cent without appreciable harm to the milk production. Whether such a substitution is practicable is thought to depend upon whether urea can be obtained in suitable amounts and at a sufficiently low price.

The substitution of protein by urea for milk producing animals. A. MORGEN, C. WINDHEUSER, and E. OHLMER (*Landw. Vers. Sta.*, 99 (1922), No. 6, pp. 359-366).—Results of experiments in conformity with those noted above are reported. These experiments were carried on with one sheep and five goats, which were fed rations of meadow hay, straw, and potato pulp. Ground soy beans, lupine meal, or urea were substituted for some of the potato pulp during alternate periods so that the starch value and the nitrogen content of the rations were nearly equal.

The authors conclude that a part of the protein may be substituted by urea without loss of milk production, but that too large amounts of urea may not be suitable. Detailed data collected from this experiment are included in the tables following an article previously noted (*E. S. R.*, 48, p. 274).

The utilization of urea for milk production in cows. W. VOLTZ, W. DIETRICH, and H. JANTZON (*Biochem. Ztschr.*, 130 (1922), No. 4-6, pp. 323-431).—In continuation of a previous investigation of the possibility of substituting urea for protein in animal rations (*E. S. R.*, 46, p. 67), and extensive series of studies was conducted on cows to determine the effect of such substitution on the yield and quality of milk. Five cows of different ages and periods of lactation were used in over 40 separate experiments, the general scheme of which was to feed for about 10 days a selected ration of either low or high protein content and then to add a definite amount of urea, or to substitute urea for a certain amount of the protein-containing feed and continue this ration for about the same length of time as the first, after which the first ration was resumed. Potatoes and sugar beets furnished the principal low protein constituents of the ration and peanut cake the high protein. The data reported include the composition of the rations and the amounts of digestible material contained therein, the amounts fed, and the yield and composition of the milk. The results of the investigation are summarized by the authors, in part, as follows:

The minimal requirement in digestible crude protein in these experiments averaged 0.33 kg. per 1,000 kg. of live weight per day. A total of 11 urea periods was carried through. The yield of milk and its constituents was in all cases increased by the addition of urea. Urea alone was added to the basal ration in 5 periods with 4 cows. With one exception the addition of urea increased to a marked extent milk secretion. Naturally the yield of milk

varied with the individuality of the cow, the period of lactation, and the protein content of the feed. From 1 kg. of urea were obtained in four experiments on 3 cows between 9.53 and 16.73 kg. of milk, furnishing between 1,188.7 and 1,834 gm. of total solids, or an average of 12.63 kg. of milk and 1,466.4 gm. of solids. If the state of lactation is taken into consideration, still higher values are obtained.

Urea in combination with a protein deficient ration was fed to 4 cows in six periods, with sugar beets to 3 cows in three periods, and with potato flakes to 3 cows in three periods. In comparison, 3 cows received the same addition in digestible crude protein and starch value in the form of peanut cake. In the experiment with peanut cake in comparison with urea and sugar beets, the yield from 1 kg. of peanut cake was 2.14 kg. of milk, furnishing 287.3 gm. solids. From the same amount of nutrients in the form of 171 gm. of urea and 4.34 kg. of sugar beets were obtained 1.19 kg. of milk containing 153.7 gm. of solids, i. e., 55.6 per cent of the amount of milk and 53.5 per cent of the yield in solids of the peanut-cake period.

In a similar comparison of peanut cake with urea and potato flakes, 1 kg. of peanut cake yielded 1.63 kg. of milk and 189.4 gm. of solids. From 177.6 gm. of urea and 1.02 kg. of potato flour 1.3 kg. of milk and 165 gm. of solids were obtained, i. e., four-fifths of the milk and about seven-eighths of the solids that were obtained from the peanut cake. The milk yield on the peanut-cake ration was affected to a greater extent by the period of lactation than on the urea and potato flake. The higher yield on the urea and potato-flake ration than with the urea and sugar beets is attributed in part to the fact that there was a more intimate mixture of the urea with the flakes than was possible with the beets.

These results are thought to furnish additional proof of the possibility of the use of urea in place of a certain amount of protein. Balance experiments on one of the animals tended to confirm this conclusion. Urea is considered of value also in increasing the appetite. The use of a limited amount of urea to supplement protein-poor rations for cattle and sheep is recommended. To obtain the greatest value the urea should be well mixed with the rest of the feed and given in not too great amounts. In general about 150 gm. daily is considered the optimum amount.

Grazing [tests at the Duluth Substation], M. J. THOMPSON (*Minnesota Sta., Duluth Substa. Rpt. 1921, pp. 28-30*).—The 1922 results are given of the summer pasture trials with helpers previously noted (*E. S. R.*, 47, p. 174). The feeding period began May 25 and lasted 161 days for the day and night pasture, during which gains of 0.98 lb. per day were made. Day pasture was continued to December 1.

Raising dairy cattle, J. O. TRETSVEN (*Montana Sta. Circ. 104 (1922), pp. 20, figs. 14*).—This circular deals largely with the principles of feeding dairy calves, but also includes information on care and management of the calves, helpers, and young bulls.

Influence of acidity on flavor and keeping quality of butter, M. MORTENSEN (*Iowa Sta. Bul. 207 (1922), pp. 87-96, fig. 1*).—This is a more complete report of work the results of which were noted (*E. S. R.*, 47, p. 784). The tests were made at creameries where the sweet cream was received and pasteurized at 145° F. for 30 minutes. It was then divided into three lots, of which two lots were cooled to 40°, one of these being left for 3 hours or longer and churned while sweet. From 10 to 20 per cent starter was added to the other lot after it had been heated to 60°. The third lot was cooled after pasteurization to from 65 to 70° and a similar amount of starter was added.

When sufficient acidity had developed in this lot, it was cooled to 40° and held for at least 3 hours before churning.

When fresh the ripened cream butter scored the highest. After 2 months' storage the scores were about equal, but after 9 months' storage the sweet cream butter scored highest, followed closely by the butter made from sweet cream with starter added.

Proportioning the ingredients for ice cream and other frozen products by the balance method, O. E. WILLIAMS (*U. S. Dept. Agr. Bul. 1123* (1922), pp. 13).—Most of this material has been previously noted (*E. S. R.*, 44, p. 576).

VETERINARY MEDICINE.

Veterinarian's handbook of materia medica and therapeutics, D. H. UDALL (*New York: Macmillan Co., 1922, 2. ed., rev., pp. 180*).—A second revised edition of this small handbook (*E. S. R.*, 28, p. 78).

Tissue reaction and antitoxin formation in horses following intrapulmonary injection of diphtheria toxin, R. KANEKO (*Ztschr. Immunitätsf. u. Expt. Ther.*, I, *Orig.*, 34 (1922), No. 5, pp. 424-443).—A study is reported of the anatomical histological findings in the lungs, and the antitoxin content of the arterial and venous blood and of the organs, of 7 horses which had received intrapulmonary inoculations of diphtheria toxin. Some of these animals also received intramuscular and subcutaneous injections and 2 controls subcutaneous injections only. With the exception of 1 horse which proved to be a poor antitoxin producer, the serum of the horses receiving intrapulmonary injections was higher in antitoxic units than the control. The findings are summarized as follows:

The lung changes consisted chiefly in chronic proliferating inflammation accompanied by more or less striking blood hemorrhages.

The antitoxin content of the lungs, liver, spleen, kidneys, and adrenals was in all cases smaller than that of the blood serum and depended largely upon the blood content of the organ in question. The venous blood was higher in antitoxin than the arterial. The lung lesions often contained significantly larger amounts of antitoxin than the other organs and than other noninoculated lungs. The spleen, generally considered to be the site of formation of various antibodies, contained only a small amount of antitoxin, often less than the other organs.

The distribution of the antitoxin in the organs and serum, as thus indicated, is considered to give no support to the theory that the lung is the principal site of antitoxin formation.

The standardization of strangles serum, V. ADERSEN (*Maanedsskr. Dyr-læger*, 33 (1921), No. 5, pp. 113-132; *abs. in Abs. Bact.*, 6 (1922), No. 6, pp. 307, 308).—The author discusses the importance of securing methods for testing and measuring the potency of antitoxic and anti-infectious serums, and points out the difficulty in the latter case with particular application to strangles serum. Attempts made by other investigators to standardize strangles serum are reviewed, and his own experience in the use of mice and rabbits for such purposes is reported.

Mice proved unsatisfactory, and rabbits gave results which could be safely used only to the extent of distinguishing between potent and nonpotent serums.

A comparison of the relative immunizing value of serums obtained by the use of living or killed cultures is also reported. While the results obtained on rabbits with serum prepared with living cultures were slightly better, the author is of the opinion that there is not sufficient difference to warrant the

use of living in place of killed cultures in view of possible infection from the living cultures.

Antigenic power in vivo and in vitro of tubercle bacilli and their extracts. L. NÈGRE and A. BOQUET (*Compt. Rend. Soc. Biol. [Paris]*, 86 (1922), No. 12, pp. 653, 654).—To determine the relative antigenic power of tubercle bacilli and various extracts prepared from the bacilli, rabbits were given four intravenous injections at 2-day intervals of 0.02 gm. of the dried organism or of 2 cc. of the various extracts corresponding to this amount of bacteria, and 1 cc. of crude tuberculin, respectively. Blood was taken 9 days after the treatment and the serum tested in turn against the various antigens.

The tabulated results show that tubercle bacilli killed by sterilization at 120° C. possessed the highest antigenic power. When the bacilli are treated with acetone alone or with both acetone and methyl alcohol the residue retains almost no antigenic properties, antibodies being detectable only with the methyl extracts and tuberculin. The corresponding extracts form antibodies only for the respective antigen. In vitro the bacilli fix complement only in the presence of the serum of a rabbit submitted to repeated bacillary injections. Treated with acetone or with acetone and methyl alcohol the tubercle bacilli also lose their antigenic property in vitro. The methyl extracts on the contrary behave in vitro as a very sensitive antigen toward all the serums except that of the rabbit treated with the acetone extracts. The most sensitive antigen in vitro is considered to be the substance soluble in methyl alcohol and insoluble in acetone.

Carriers in infectious diseases. H. J. NICHOLS (*Baltimore: Williams & Wilkins Co.*, 1922, pp. 184, figs. 13).—This work includes a section by R. A. Kelsner (part 4, pp. 121-180) on carriers in veterinary medicine. The first of the three chapters in this section takes up carriers of organisms pathogenic for both man and the lower animals, including *Micrococcus melitensis*, *Bacillus tuberculosis*, organisms of the Salmonella, enteritidis, or Gaertner group, *B. tetani*, *B. oedematis maligni* (*Vibrio septique*), *B. anthracis*, *B. mallei*, *B. diphtheriae*, *B. pestis*, *Bacterium tularensis*, *Bacillus erysipelatis suis*, miscellaneous facultative-pathogenic bacteria, *Leishmania canis*, and the virus of foot-and-mouth disease. The second chapter deals with carriers of organisms pathogenic for animals and possibly for man, including Streptococcus of infectious mastitis of cattle, *Bacterium abortus* (Bang), trypanosomes, and other protozoal and metazoal infections. The third chapter is devoted to carriers of organisms pathogenic for the lower animals only, including *Bacillus bipolaris septicus*, *B. necrophorus*, *B. paratuberculosis*, *Bacterium pullorum*, *Piroplasma bigeminum*, *P. bovis*, *P. caballi*, *Nuttallia equi*, the virus of equine infectious anemia, the virus of contagious pleuropneumonia of cattle (*Asterococcus mycoides*), the virus of equine influenza, and the virus of hog cholera. In the concluding chapter a list is given of 51 references to the literature cited.

How to get the last tick. W. M. MACKELLAR (*U. S. Dept. Agr., Bur. Anim. Indus.*, 1922, pp. 20, figs. 7).—This is a popular discussion of methods.

A contribution to the bacteriology and pathology of sterility in cows, with report of 19 cases. D. C. BEAVER (*Jour. Amer. Vet. Med. Assoc.*, 61 (1922), No. 5, pp. 469-502, pls. 6).—This is a detailed report of studies of 19 cases conducted at the Minnesota Experiment Station. The author's investigations have shown streptococci and *Bacillus pyogenes* to be the organisms most important in infections of the genital tract of the cow and to be responsible for the greater number of infections. It is pointed out that unless the bacteriological study is made during the progress of active infection, these types as well as others will most often not be found. The absence of *B. abortus* (Bang) supports the previous view that it is not found in puerperal infections that

persist for any length of time, and that it does not persist, so far as is known, in the genitalia of the cow.

A list of 18 references to the literature is cited.

The rôle of the udder and its secretion in bovine infectious abortion, W. GLTNER, I. F. HUDDLESON, and R. L. TWEED (*Jour. Amer. Vet. Med. Assoc.*, 62 (1922), No. 2, pp. 172-178).—The authors fail to support the assertion that milk from the udder carrying *Bacterium abortus* is an important factor in the transmission of bovine infectious abortion. A bibliography of 26 titles is included.

Infectious abortion of cattle, B. T. SIMMS and F. W. MILLER (*Oregon Sta. Bul.* 192 (1922), pp. 12, fig. 1).—This is a summary of information based upon studies in Oregon in 1919 and 1920.

The protection of lambs from stomach worms, C. CURTICE (*Jour. Amer. Vet. Med. Assoc.*, 61 (1922), No. 5, pp. 529-533).—This is a report of tests made by the U. S. D. A. Bureau of Animal Industry during the past eight years, in which the administration of bluestone solution has been the only satisfactory means of controlling stomach worms under practical conditions. The stock solution is made by dissolving 1 lb. of coarsely powdered copper sulphate in 2 qt. of boiling water. Four ounces of this stock solution added to 3 qt. of water is sufficient for treating 25 head of sheep, 4 oz. of the diluted solution being given to each sheep weighing 80 lbs. or over. Sheep on the farm should be dosed with the solution every four weeks throughout the year, with the exception of unweaned lambs and of pregnant ewes within two weeks of lambing.

Sequels of hog cholera immunization, A. T. KINSLEY (*Vet. Med.*, 17 (1922), No. 12, pp. 772-775).—This is a general discussion of some of the possible causes of failure in the immunization against hog cholera. Among the points considered are the lack of care in preparing the animals for the inoculation and in their treatment following inoculation, possible contamination of the serum or virus with other pathogenic organisms, poor technique in administering the serum and virus, and possible attenuation of the serum or virus.

Remarks on "hog flu," M. DORSET, C. N. MCBRYDE, and W. B. NILES (*Jour. Amer. Vet. Med. Assoc.*, 62 (1922), No. 2, pp. 162-171).—This is a discussion presented at the annual meeting of the American Veterinary Medical Association held at St. Louis, Mo., in August, 1922.

Pathogenicity of *Bacterium suisepiticus* for hogs, A. F. SCHALK and L. M. RODERICK (*Jour. Amer. Vet. Med. Assoc.*, 62 (1922), No. 3, pp. 343-348).—In experiments with *B. bipolaris suisepiticum* the authors have failed to produce any apparent infection in hogs. They were led to conclude from the experiments and routine laboratory examinations that while this organism is present in the lungs of the hogs, particularly those in which a pneumonic process exists, its rôle in the production of disease is a minor one, and that it is at most an accidental invader.

The character and possible significance of the Bang abortion bacillus that attacks swine, W. E. COTTON (*Jour. Amer. Vet. Med. Assoc.*, 62 (1922), No. 2, pp. 179-192).—After summarizing the results of investigations conducted by the U. S. D. A. Bureau of Animal Industry, the author feels justified in concluding that the work of the State experiment stations and of the bureau have proved "(1) that the organism which causes a large share of the abortion among swine is an aberrant or extra virulent type of *B. abortus*; that this organism causes certain lesions to form in guinea pigs that are unlike those produced by the organism commonly attacking cattle, and that *B. abortus* which attacks swine can be differentiated from that which attacks cattle only, by the use of guinea pigs; (2) that sows become carriers through infection of

their udders, that the infection may reappear in their uteri at subsequent pregnancies, as in the case with cows, and that cattle can be infected with the swine bacillus, at least by intravenous injection."

The control of equine infectious abortion in the United States Army, G. H. KOON and R. A. KELSEY (*Jour. Amer. Vet. Med. Assoc.*, 62 (1922), No. 2, pp. 193-196).—The demonstration of the value of the abortion bacterin as a prophylactic agent led to the administration of it during the years 1920 and 1921 to all Army brood mares in foal, and beginning with the year 1922 to all brood mares at the remount depots whether in foal or not and also to all stallions.

The results obtained have led the authors to conclude that abortion due to *Bacillus abortus equi* can be effectively controlled by the use of properly prepared bacterins. Mares, even though in advanced pregnancy, suffer no ill effects from bacterin administration. It is pointed out that the bacterin treatment renders the complement-fixation test for the diagnosis of the disease practically valueless for the animals thus treated.

Equine infectious anemia, R. A. KELSEY (*Jour. Amer. Vet. Med. Assoc.*, 62 (1922), No. 3, pp. 319-331, figs. 8).—The author reports upon an outbreak of this disease which took place among the brood mares of the Remount Depot at the U. S. Army Post at Fort Robinson, Nebr., in November, 1921. With the exception of one case in a colt, the disease was confined exclusively to the brood mares of the depot, in a group of some 100 animals. At the time of the investigation there had been 28 cases, of which 15 had terminated fatally, 6 had been discharged, and 7 were still sick.

Normal temperature of the adult domestic fowl, B. F. KAUPP (*Jour. Amer. Vet. Med. Assoc.*, 61 (1922), No. 5, pp. 520-528).—After a brief historical review of the subject, which is accompanied by references to the literature, the author reports upon studies commenced in 1917 at the North Carolina Experiment Station. The cloacal temperatures of three lots of adult fowls are recorded.

"The temperatures of these fowls were highest at night, gradually becoming lower after the fowl goes to perch, till at midnight all surplus heat from the body is apparently eliminated, and the average fell to 104.5° F. Nearing dawn the birds become restless and soon begin to move about, which causes surplus heat to accumulate in the body. At this time the average temperature was 105.7°. From this time till noon the temperature gradually rose to 106.6°, and by 5 p. m. had reached 106.9°. These temperatures were taken during the month of February, hence the fowls were not subjected to high atmospheric temperatures, and as a result the temperatures are slightly lower than some given in the historical review, where at the time of taking the temperatures hot noon-day weather prevailed. The average of the daylight temperatures was approximately 106.8°, or 0.6° below the average of all authors quoted in the historical review. From all studies recorded it would appear that 107.3° is an annual approximate temperature, while this is likely to be slightly more during warmer and less during the colder weather."

A record is given of later temperatures of the same fowls. It was found that there is apparently no difference between the temperatures of the males and the females.

Potassium nitrate poisoning in chickens, with a note on its toxicity, J. E. GUBERLET (*Jour. Amer. Vet. Med. Assoc.*, 62 (1922), No. 3, pp. 362-365).—The author reports upon poisoning in a flock of 225 fowls, in which potassium nitrate had by mistake been fed in a bran mash for Epsom salts.

In experiments conducted with a view to determining the toxic and lethal doses of potassium nitrate, he found that under range conditions small doses

produced no apparent external symptoms. Doses of 15 to 20 grains produced diarrhea and a diuretic condition after two or three hours, but then as rule only after the birds had taken water. Fowls taking 25 to 30 grains under these conditions showed toxic symptoms, while 60 grains was a lethal dose for a 3.5-lb. hen and 65 to 70 grains were fatal to birds weighing 4 to 4.5 lbs. Toxic doses of potassium nitrate produced symptoms of gastroenteritis, nephritis, muscular weakness, slow, weak pulse, depression of the circulation, disturbed respiration, and slight hemolysis of the blood.

"Very small doses, 1 to 2 grains, produced diuretic action with diarrhea in two to three hours provided water was near the birds constantly so that they could drink of it at any moment. This was especially true if the saltpeter was given in solution. In doses of 5 to 10 grains the same results were noted, except that the diarrhea and diuresis were more severe. Doses of 45 grains produced diuretic action in 40 to 45 minutes when the birds had constant access to water. Under these conditions doses containing 45 to 50 grains were toxic, and it required 80 to 90 grains for a lethal dose for fowls weighing 4 to 4.5 lbs."

Handbook of the diseases of fowls, R. REINHARDT (*Handbuch der Geflügel-Krankheiten*. Hannover: M. & H. Schaper, 1922, pp. 307, figs. 28).—The first part of this work relates to the infectious diseases of fowls (pp. 9–118), the second to the parasitic diseases (pp. 119–171), the third to poisoning (pp. 172–191), the fourth to organic diseases (pp. 192–270), the fifth to deranged metabolism (pp. 271–287), the sixth to the vices of the fowl (pp. 288–292), and the seventh to operations (pp. 292–298).

Concerning the diagnosis of *Bacterium pullorum* infection in the domestic fowl, G. E. GAGE (*Massachusetts Sta. Tech. Bul.* 5 (1922), pp. 61–88, pl. 1, fig. 1).—This is the report of an investigation covering a period of several years on the diagnosis of *B. pullorum* infection in chickens and adult fowls. A brief summary of the literature on the subject is first given. This is followed by cultural and biochemical studies of 112 strains of *B. pullorum* isolated from diseased material in different parts of the State and of 5 strains of *B. sanguinarium*. *B. pullorum* A is described as a slender, nonmotile, nonliquefying, Gram-negative organism which does not coagulate or peptonize milk, produces gas in dextrose and mannite, forms hydrogen sulphid in lead acetate media, does not produce indol, and does not reduce nitrates. *B. pullorum* B is characterized from *B. pullorum* A by its inability to produce gas from dextrose. The fowl typhoid organism, *B. sanguinarium*, is characterized as an anaerogenic, nonmotile bacillus which does not form indol nor reduce nitrates, but forms hydrogen sulphid in lead acetate media. Neither *B. pullorum* A nor B forms acid in maltose, dextrin, and dulcitol media, while *B. sanguinarium* forms acid in these media.

In the examination of more than 600 specimens of adult fowls, the true *B. sanguinarium* culture was identified only six times and *B. pullorum* B only a few times. During the same period the examination of 289 chicks with a history of bacillary white diarrhea gave positive results for *B. pullorum* A in all but one case.

In the bacterial examination of 83 birds showing paralysis, 5 only showed the presence of *B. pullorum* A infection and none of *B. pullorum* B or *B. sanguinarium*.

Considerable evidence is presented that the presence of *B. pullorum* infection in the adult hen has a decided influence on the hatching quality of the eggs and the viability of the young stock, and that birds reared from positively agglutinating hens tend to develop after about 6 months positively agglutinating sera although there exists an interagglutinability of *B. pullorum* with *B. sanguinarium*, *B. typhosus*, *B. paratyphosus* A and B antigens. It is considered

that the agglutination test, when carefully controlled, is at present the best method of locating *B. pullorum* infection. As evidence of this, data are given on the identification of cultures isolated from dead chicks which had been hatched from eggs laid by positively reacting breeding birds. With the exception of one culture, all cultures obtained from the dead chicks hatched by 924 positive reactors proved to be *B. pullorum* A.

Control work with contagious epitheliosis, H. R. LEWIS (*New Jersey Stat. Rpt. 1921, pp. 128-142*).—This report consists largely of a review of the work which has been done at the Ohio, Nevada, California, and Missouri Experiment Stations on chicken pox, roup, and canker. This is followed by the outline of a campaign which has been instituted by the station among poultry raisers of the State in an effort to control these diseases by vaccination according to the method described by Beach and used with considerable success in California (E. S. R., 47, p. 685). A list is given of the cooperating parties in this control plan and of the responsibility to be taken by each. The method of administration of the vaccine is described in detail.

A new method for detecting the eggs of parasites in feces, T. VAJDA (*Jour. Amer. Vet. Med. Assoc., 61 (1922), No. 5, pp. 534-536, fig. 1*).—The author describes a new method by which a great number of eggs can be isolated from a very small quantity of feces (0.5 gm.), he having counted 1,358 *Ascaris lumbricoides* eggs in one preparation and 1,130 in another. By this method the specific gravity of the diluted fecal material is changed through the addition of glycerin. The eggs rise to the surface of the liquid, they become more transparent, and their structure is more readily visible.

The application of Vajda's method of the examination of fox feces, J. A. ALLEN (*Jour. Amer. Vet. Med. Assoc., 62 (1922), No. 3, pp. 349-352*).—The experiments here reported are considered to justify the unqualified conclusion that Vajda's method above noted for the detection of the ova of the parasites is at least as accurate as the centrifugal method.

RURAL ENGINEERING.

Procedure for securing State approval of formation of irrigation districts, issuance of bonds by irrigation districts, expenditure of construction funds by irrigation districts, construction of dams (*Calif. Dept. Pub. Works, Div. Engin. and Irrig. Bul. 2 (1922), pp. 14*).—This is apparently an interpretation of the California State laws covering the subjects named.

Administration report for the [fiscal] year 1919-20 [irrigation], A. H. MORIN and E. D. CHANTER (*Madras Pres. Irrig. Branch, Admin. Rpt. 1919-20, pt. 2, pp. VIII+209, pls. 15*).—This report deals with the work, expenditures, and revenues of the Irrigation Branch of the Public Works Department of the Madras Presidency for the year 1919-20.

Columbia Basin project, G. W. GOETHALS ET AL. (*Olympia: Wash. Dept. Conserv. and Development, 1922, pp. 56, pls. 5*).—A summary is presented of the reports of the general survey of the Columbia River Basin irrigation project and the survey of the construction problems to be encountered in the irrigation of the land lying within the area.

It is stated that of over 3,000,000 acres of land embraced within the Columbia River Basin lying between the Columbia and Snake Rivers, 1,753,000 are irrigable by the gravity project, which provides water by gravity flow from the Pend Oreille River, and 1,403,000 by the pumping project, which provides water from the Columbia River. The estimated cost of the gravity project is \$144.90 per acre, and the cost of operation and maintenance 48 cts. per acre per annum. The lowest estimated cost for the pumping project is \$159.01 per acre, and the cost of operation and maintenance from \$1.51 to \$1.86 per acre

per annum. The gravity project is recommended for adoption. It is concluded that the project is justified from an economic standpoint if the land can be made ready for planting at a cost ranging from \$200 to \$275 per acre.

Surface water supply of Pacific slope basins in Washington and upper Columbia River Basin, 1918 (*U. S. Geol. Survey Water-Supply Paper 482*, pp. V+173, pls. 2).—This report, prepared in cooperation with the States of Washington and Montana, presents the results of measurements of flow made on streams in the Pacific Basins in Washington and in the upper Columbia River Basin during the year ended September 30, 1918.

Surface water supply of lower Columbia River and Pacific slope drainage basins in Oregon, 1918 (*U. S. Geol. Survey Water-Supply Paper 484* (1922), pp. V+141, pls. 2).—This report, prepared in cooperation with the States of Oregon and Washington, presents the results of measurements of flow made on streams in the lower Columbia River Basin and in Pacific slope drainage basins in Oregon during the year ended September 30, 1918.

Surface water supply of western Gulf of Mexico Basins, 1918 (*U. S. Geol. Survey Water-Supply Paper 478* (1922), pp. IV+106, pls. 2).—This report, prepared in cooperation with the State of Texas, presents the results of measurements of flow made on streams in the Trinity, Brazos, Colorado, Guadalupe, San Antonio, Nueces, and Rio Grande River Basins during the year ended September 30, 1918.

Coefficients of discharge for suppressed submerged orifices, J. HINDS (*Reclam. Rec. [U. S.]*, 13 (1922), No. 10, pp. 253-255, fig. 1).—The results of experiments upon six sizes of suppressed submerged orifice are presented in tabular form and discussed, and a typical diagram for a 1 by 4 ft. orifice is given. The discharge coefficient varied from 0.61 for a 0.5 by 2 ft. orifice to 0.645 for a 1 by 2 ft. orifice.

Combined irrigation and drainage plant in Louisiana, A. M. SHAW (*Engin. News-Rec.*, 89 (1922), No. 18, pp. 741-744, figs. 3).—A system of combined drainage and irrigation in use in Louisiana on rice soils is described and the important features illustrated. In this system the pumping plant, consisting of one oil-engine pump, delivers or removes water as needed on the rice plantation. Two ditch systems with control gates are used.

The beginnings of field drainage, H. G. RICHARDSON and G. E. FUSSELL (*Jour. Min. Agr. [London]*, 29 (1922), No. 7, pp. 585-591).—This is a brief review of the history of land drainage in England from about the thirteenth century.

Land clearing operations in 1921, M. J. THOMPSON (*Minnesota Sta. Duluth Substa. Rpt.*, 1921, pp. 30-32, fig. 1).—Brief data are reported indicating that with the standards used for cost of labor and materials, the effect of fire is to reduce the cost of land clearing.

Investigations in the structure of road surfaces, F. WOOD (*Inst. Civ. Engin. [England] Minutes Proc.*, 207 (1918-19), pt. 1, pp. 144-157, figs. 2).—A number of studies on the structure of road surfaces are summarized, from which the conclusion is drawn that wood paved and asphalted roads are particularly suited for motor traffic, but that wood paved roads will always be more expensive than asphalt roads.

Road corrugation, E. L. LEEMING (*Inst. Civ. Engin. [England] Minutes Proc.*, 207 (1918-19), pt. 1, pp. 123-143, figs. 15).—This is an analysis of the causes and effects of road corrugation.

Further progress of rural distribution, J. W. PURCELL (*Elect. News*, 31 (1922), No. 3, pp. 32-36; *abs. in Sci. Abs., Sect. B—Elect. Engin.*, 25 (1922), No. 293, p. 327).—An analysis of the distribution of electrical energy in rural districts in the Province of Ontario, Canada, is presented, indicating that the

main classifications and descriptions of service required are (1) hamlet service, where four or more customers are served from one transformer suitable only for appliances up to from 600 to 750 watts, (2) house lighting, (3) light farm service, such as lighting and power for miscellaneous small equipment or single-phase motors not exceeding 3 h. p., (4) medium farm service, single phase, for lighting and power using motors up to 5 h. p., (5) medium farm service, 3-phase, for use as in class 4, (6) heavy farm service for lighting and power up to 10 h. p., (7) special farm service for power for 3-phase motors up to 20 h. p., and (8) syndicate service, which includes any of the above classes which may join in the use of a syndicate outfit. It is assumed that three farmers per mile of line or the equivalent are obtainable on an average. Tables of figures giving details and costs of installations, annual uses, annual cost, and work done are included.

The chemical control of gaseous detonation with particular reference to the internal-combustion engine, T. MIDGLEY, JR., and T. A. BOYD (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 10, pp. 894-898, fig. 1).—This is an analysis of the bearing of gaseous detonation on the operation of internal-combustion engines, and a progress report of experiments, the purpose of which is to control such detonation by chemical means.

It has been found that detonation in internal-combustion engines can be either suppressed or induced by the presence of very small amounts of certain materials in the combustion mixture. These substances may be dissolved or suspended in the fuel, or they may be admitted to the combustion chamber in some other way. It is stated that the action of practically every type of compound that should affect detonation has been tried, and a large number have been found to possess the property of affecting combustion in such a way as either to suppress or induce detonation.

The compounds which possess this property of affecting the reaction velocity of combustion to a marked degree are chiefly derivatives of about 15 elements. Oxygen and the halogens in the elemental form exert a marked effect on combustion. Iodin is an antiknock material, and the other elements induced detonation to different degrees. A great many nitrogen compounds are effective antiknock materials, probably the best of which are the aromatic amines. Certain compounds of selenium, tellurium, tin, and lead are remarkably effective for the suppression of knock, while some compounds of arsenic, antimony, and phosphorus have a marked but lesser effect for preventing knock. The effects of antiknock materials on detonating combustion are described.

Studies on frictional losses in internal-combustion motors, A. PLANIOL (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 13, pp. 860-863).—A series of experiments extending over two years with a single cylinder, 4-stroke cycle, 30 h. p. internal-combustion engine, operating on illuminating gas, is reported, the purpose of which was to determine the relation between friction losses and means pressure. An equation of the form $Cf = a + b\pi$, in which Cf is the friction, and π the mean pressure, was found to express the relation correctly for the experimental motor to within 0.5 per cent when the constants a and b have values of 16 and 4.5, respectively.

Further experiments to determine the modifications of this formula necessary to make it applicable to other motors of different horsepower are also described. The above formula was modified to the form $Cf = C(a + b\pi)$, in which C is the maximum couple. Thus for the experimental motor this equation resolved itself into $Cf = 140(0.114 + 0.032\pi)$. On this basis the values actually found for a and b for a 35 h. p. motor were 0.115 and 0.033, respectively. It is thought that this method may simplify the calculation of the efficiency of an internal-combustion motor.

Proceedings of the twenty-eighth annual convention of the National Association of Farm Equipment Manufacturers and annual reports of the officers, committees, and departments (*Natl. Assoc. Farm Equipment Manfrs. Proc.*, 28 (1921), pp. 185, pl. 1, figs. 18).—The details of these proceedings are presented and include a number of special reports, among which is one on standardization of farm equipment, by E. A. White.

The design of masonry structures and foundations, C. C. WILLIAMS (*New York and London: McGraw-Hill Book Co., Inc.*, 1922, pp. VIII+555, pls. 2, figs. 266).—This is a textbook on the subject which is intended to cover the fundamental principles rather than to describe typical examples. An attempt has been made in every case to offer a mode of analyzing forces and calculating resulting stresses and to indicate an acceptable method of design. Chapters are included on general principles, masonry laid in mortar, plain concrete, reinforced concrete, masonry arches, dams and sea walls, retaining walls and quay walls, bridge abutments and piers, concrete viaducts and trestles, culverts and underground conduits, bins and chimneys, masonry forms and falsework, foundations on dry ground, open foundations under water, and foundations under water—pneumatic process.

Sweet potato storage in Texas, E. A. MILLER, M. R. BENTLEY, and J. J. TAUBENHAUS (*Tex. Agr. Col. Ext. [Bul.] B-60* (1922), pp. 32, figs. 22).—This bulletin gives practical information on the harvesting, grading, and storing of sweet potatoes in Texas, and describes, diagrammatically illustrates, and gives bills of materials for special types of storage house developed for Texas conditions. It is noted that parts of this bulletin are extracts and reprints from a previous publication (*E. S. R.*, 42, p. 787).

Building plans for the dairy farm, J. B. KELLEY, J. J. HOOPER, and E. G. WELCH (*Ky. Agr. Col. Ext. Circ. 128* (1921), pp. 48, figs. 35).—The purpose of this circular is to present by discussion and illustration the most essential features of a good dairy barn. Diagrammatical illustrations, tabular working data, and bills of materials to cover different types of barns to meet varying conditions, especially in Kentucky, are included.

The planning and construction of cow sheds, H. P. G. MAULE and A. E. ASTON (*Jour. Min. Agr. [London]*, 29 (1922), No. 4, pp. 311-319, pls. 4).—Practical information on the planning and construction of cow sheds, with particular reference to conditions in England, is presented in this article together with descriptions and illustrations of typical structures.

Rhode Island poultry pointers, H. R. LEWIS (*R. I. State Col. Ext. Bul. 16* (1922), pp. 6, figs. 3).—Practical information, working plans, and a bill of materials for an economical poultry house suitable for a flock of from 40 to 50 birds are presented in this bulletin. The house described is said to be suitable for housing layers as well as for colony brooding, and may be used on a multiple unit basis under Rhode Island conditions.

A preliminary study of the problem of freezing in the septic tank system of sewage disposal, R. R. GRAHAM (*Sci. Agr.*, 3 (1922), No. 2, pp. 65-68, figs. 5).—Studies conducted at the Ontario Agricultural College on the problem of freezing in septic tanks and in final disposal systems are reported.

Birecord thermometers were installed, one over an experimental septic tank and the other over an absorption bed. One bulb of the latter thermometer was placed down into the tile of the absorption bed 2 ft. below the surface, and the other bulb 3 ft. above the ground to record the air temperature. Three ordinary soil thermometers were inserted in the soil over the absorption bed, one directly over the tile but only 1 ft. deep and the other two midway between two rows of the tile, one 2 ft. deep and the other 1 ft. deep.

The results of the readings showed that the temperature of the soil at 1 ft. depth over the tile was about 2° higher than that of the soil at the same depth midway between two rows of tile and about 2 ft. away. The temperature in the tile was 5° or more higher than that of the soil at the same depth midway between the rows of tile.

The average air temperature for the three months of the study was approximately 20° F., the average temperature in the tile about 40°, in the receiving chamber about 53°, and in the flushing chamber 44°. For the whole period there was a range of 52° in the air temperature, 10° in the tile, 27° in the receiving chamber, and 22° in the flushing chamber. The lowest temperature in the air was -6°, in the tile 34°, in the first chamber 44°, and in the second chamber 34°. The effect of the heat generated by the bacteria in the first chamber was very pronounced, and it is noted that the temperature in the tile was very similar to that in the second chamber.

This is taken to indicate that if tanks are kept well covered the temperature in the tile may be controlled to a large degree. It is also thought that if the absorption bed is covered with from 6 to 8 in. of straw, the temperature in the tile may be maintained at a safe point even in the coldest weather. The studies are being continued.

Coefficients of discharge of sewage sprinkler nozzles, F. W. GREVE, JR., and W. E. STANLEY (*Purdue Univ. Engin. Expt. Sta. Bul. 3* (1919), pp. 29, figs. 12).—The results of a series of experiments conducted to determine the coefficients of discharge of several types of sewage sprinkler nozzles are presented in this report.

It was found that the relation of the logarithms of head and discharge can be represented by a straight line for all of eight nozzles tested with the exception of a special round type. It is considered essential that care be taken in fixing the position of the cone in adjustable nozzles. Lowering the bottom of the cone below the level of the orifice was found to have a more serious effect upon the rate of discharge than did the raising of the cone above the same level. This was brought about by the fact that the net area of the discharge opening was decreased as the cone was lowered. The coefficient of discharge remained constant for all nozzles when the head was greater than 1.5 ft., except for the round nozzle noted above. The rate of discharge for square nozzles could be increased by reaming the inner edge of the orifice.

A bibliography and tables of data are included.

Report of a test of floor oils, M. F. SNYDER (*Jour. Home Econ.*, 14 (1922), No. 3, pp. 137, 138).—A floor oil consisting of one part of boiled linseed oil to three parts of turpentine, as shown by experimental data reported from the U. S. D. A. Office of Home Economics, had a cleansing effect and neither injured the gloss nor darkened the floor on which it was used. A commercial oil used in the same way, darkened the floor on which it was used but did not injure the gloss. A mixture of motor oil and kerosene decidedly darkened the floors on which it was applied, and also tended to dull the finish of the wood.

RURAL ECONOMICS AND SOCIOLOGY.

Report of work in agricultural economics, A. G. WALLER (*New Jersey Stas. Rpt. 1921*, pp. 270-285).—Investigational work on the cost of producing farm products carried on in cooperation with the U. S. Department of Agriculture is reported on here.

Cost of producing can-house tomatoes (pp. 270-272).—The data summarized have been published in detail (E. S. R., 45, p. 796).

Cost of onion production, 1920 (pp. 273, 274).—Records were obtained on 16 farms growing a total of 121.75 acres of onions. The yield sold per acre in 1920

was 179.7 hampers, but the prices were so discouraging that an average of 62 hampers per acre remained unsold. It cost \$279.28 an acre, or \$1.55 per hamper, to produce and market the quantity sold. Had the entire crop been marketed, the acre cost would have been \$291.97, or \$1.21 per hamper. The farmers received an average of 74.5 cts. per hamper for those sold. The four principal items of the cost of onion growing were sets, fertilizers, manures, and man labor, amounting to 15, 14, 13, and 30 per cent, respectively, of the total cost.

Cost of milk production, 1921 (pp. 274-276).—The cost of milk production in Sussex County and in Salem and Cumberland Counties, together designated as South Jersey, is compared. The 15 farms in South Jersey were producing an average of 500 qt. more per cow annually than those in Sussex County. Yet the cost of production per quart in South Jersey was 6.78 cts. as compared to 6.75 cts. in Sussex County. The higher-priced cows in South Jersey required more attention in the way of cow testing, tuberculin testing, and the care of the veterinarian. The cost of buildings and dairy equipment per cow were considerably higher in this region. Man labor was 4 cts. an hour cheaper, a larger amount of silage was used, and cows were kept on pasture two months longer, but the feeding of more concentrates and roughage requiring 20 hours more of man labor in order to get the higher production per cow made the cost likewise higher.

Cost of tractor operation (pp. 277-284).—Records were obtained of 88 tractors in Monmouth, Burlington, and Cumberland Counties, N. J. The average cost per hour of field work performed by the tractor was \$1.395 in addition to the cost of the operator, which is taken in this study at the flat rate of 40 cts. per hour. The five items of depreciation, fuel cost, repairs and new parts, interest, and lubrication are said to make up 94 per cent of the operating cost exclusive of the operator.

It is shown that the tractor was used for field work 317 hours and for belt work 49 hours during the year. The actual running expenses exclusive of the operator's time, were \$1.62 per hour of field work on the potato farms in Monmouth County as compared with \$1.23 in Burlington County where fruit was a dominant crop. The number of hours a tractor was used ranged from 77 to 821 hours, with the corresponding range of cost per hour of \$3.88 and \$1.31, for field work. The average rate of plowing was 6.22 acres per day, at a cost of \$2.44 per acre in Monmouth and \$2.06 in Burlington, exclusive of the operator's time.

Brief note is made of the cost of harrowing and disking and other field work.

Following the acquisition of a tractor, the size of farm was increased 7.4 crop acres in Monmouth and 9.5 in Burlington County. The depth of plowing was increased 0.6 in. in Monmouth County and 1.3 in. in Burlington. Man labor saved in Monmouth County amounted to 4.5 months per tractor and in Burlington County 5.8 months. Some farm equipment was disposed of, amounting to \$26 per tractor in Monmouth and \$28 in Burlington County.

The intensity of cultivation, B. H. HIBBARD (*Quart. Jour. Econ.*, 36 (1922), No. 4, pp. 646-665).—The problem of intensity of cultivation is viewed from three standpoints, namely: (1) It may be assumed that entrepreneurship is fixed and that capital and land are applied to it in various amounts, (2) land may be viewed and fixed and capital varied, entrepreneurship being taken for granted, and (3) capital may be fixed and land varied, entrepreneurship still being assumed. An illustration is given of the difficulty of the trial method as a means of arriving at the optimum apportionment. It is held that all managers, marginal and submarginal, large and small, will find no stopping place in applying land to capital until the last dollar just balances the cost, until the last acre of land just pays for itself, and until the proportion is such that

land and capital are alike in returns per value unit. The income will be alike for all at the margin. Of proportions and of average incomes there may be no two alike. It is also pointed out that during each year the problem assumes different aspects. The effect of change of price of produce and of a change in wages or capital cost on intensity of culture are discussed.

The agricultural landowner and his duties (*Estate Mag.*, 22 (1922), No. 10, pp. 641-650; also in *Nature* [London], 110 (1922), No. 2763, pp. 501-503).—These are abstracts of the paper by Lord Bledisloe before the meeting of the agricultural section of the British Association for the Advancement of Science at Hull.

The author pointed out what he considered certain signs that the British tenant system of farming is breaking down. He urged British landowners to take more active interest in the direction of farming operations on their estates and to find the profitable market outlets for the agricultural produce. He declared also that they should stimulate education among their tenants, and cultivate a wider appreciation in their own ranks of the application of scientific principles to farming.

Cooperative land colonization, F. OPPENHEIMER (*Die Siedlungsgenossenschaft. Jena: Gustav Fischer, 1922, 3. ed., pp. XXIV+III+XXI+638*).—The three books comprising this discussion of cooperative as opposed to communistic principles applied to the solution of cooperative problems and agrarian questions are concerned, respectively, with city purchasers' and sellers' cooperatives, agricultural laborer-producers' cooperation, and cooperative land colonization. An exhaustive summary is given of the history and development of each phase of cooperative activity. In the last book numerous community colonization experiments in different countries are described, and the social theories and plan of action of leaders in this field are set forth.

Bank credit and agriculture under the national and Federal reserve banking systems, I. WRIGHT (*New York and London: McGraw-Hill Book Co., Inc., 1922, pp. XII+340, figs. 21*).—An analysis is made of the needs for and conditions of short-term agricultural credit under the existing banking systems. The first two chapters set forth the short-term and intermediate credit needs of agriculture, together with the problems involved. Chapters 3 and 4 outline the relationship between the banking facilities of the country and agriculture up to the passage of the Federal Reserve Act. Chapter 5 aims to summarize the consequences of the legal and economic restrictions which handicapped the financing of agriculture before 1914. Chapters 6, 7, and 8 present the features of inelastic credit in relation to agriculture under the national banking system; 6 shows the rise and decline of call loan interest rates at the New York Stock Exchange as affected by the interior demands for currency for making and moving the crops; 7 and 8 are outlines of the seasonal movements of currency between geographical districts and between the principal cities as affected by the demands for agriculture. Chapter 9 contains a summary of the economic and political reasons for the special provisions for agricultural credits. Chapter 10 aims to explain the provisions for agricultural credit under the Federal Reserve Act and their application. Chapters 11 to 15, inclusive, attempt to show how the Federal reserve system functions in relation to agriculture and especially how the volume of credit extended to agriculture necessarily varies with economic conditions. The seasonal movements of currency under the Federal reserve system are explained in chapter 16, and 17 is a study of the rediscount rates under the system and a comparison of the rates for 60- to 90-day paper and agricultural and live stock paper maturing after 90 days. Chapter 18 aims to show the causes for the variation in interest rates in

different sections of the country. Chapter 19 outlines the use of the Federal reserve system by the farmer and the country banker, and suggests methods of improvement; in chapter 20 the chief criticisms against the Federal reserve system are summarized and analyzed; and chapter 21 summarizes the conclusions drawn respecting the present banking facilities and agriculture. The appendixes set forth the fundamental principles of the bank credit facilities provided for agriculture in foreign countries, the mortgage credit facilities in the United States and foreign countries, and the work of the War Finance Corporation.

The landschaften and their mortgage credit operations in Germany (1770-1920), M. TCHERKINSKY (*Rome: Internatl. Inst. Agr., Bur. Econ. and Social Intel.*, 1922, pp. 90).—An account is given in part 1 of the origin and historical development of land credit institutions to meet the needs of the landed nobility and of their later modification to admit peasants to membership. Part 2 is devoted to a detailed discussion of their organization and working rules and regulations. An extensive bibliography is appended.

Weather, Crops, and Markets (*U. S. Dept. Agr., Weather, Crops, and Markets*, 2 (1922), Nos. 23, pp. 481-496, figs. 2; 24, pp. 497-512, figs. 4; 25, pp. 513-528, figs. 2; 26, pp. 529-576, figs. 2; 27, pp. 577-592, figs. 2).—The usual weekly notes as to the weather and its effect on crop conditions in certain areas, together with temperature and precipitation charts, are given in these numbers for the weeks ended November 28 and December 5, 12, 19, and 26, 1922. Statistical reports on market receipts, prices, and the position in the market of important products and classes of crops and live stock, as well as special articles on local or outstanding market situations, are given.

It is announced that a system of reporting twice a year the quantity of sweet potatoes in storage in the United States is now being worked out. The final cotton crop estimate is submitted in No. 25, giving the total production in the United States for the season of 1922-23 as 4,767,262,000 lbs., not including linters, or 9,964,000 bales of 500 lbs. each, this season's production being about one-fourth larger than that of last year.

The December crop report is given in No. 26, and includes a summary of the acreage, production, and farm value of important crops, 1920 to 1922; statistics by States of acreage, yield per acre, production, farm price December 1, total farm value, and average value per acre of 24 important farm crops for the same years; monthly average farm prices of 21 crops through longer periods of years; miscellaneous summaries of crop acreages and prices and the usual averages of prices received by producers, with comparisons; and the estimated farm value of important products.

Results of a survey involving a questionnaire sent to 25,000 crop reporters to be filled in by farmers as to the percentage of their food supply that is produced locally are tabulated in detail and commented upon in No. 27. It is reported that about 60 per cent of the food consumed on American farms is produced on the farms where consumed.

The American live stock market: How it functions, A. C. DAVENPORT (*Chicago: Drovers Jour. Print*, 1922, pp. 174, figs. 40).—Twenty chapters in this description of markets and market methods in actual practice pertain to the development of American markets, the transportation of live stock, stockyards companies and service, live stock commission firms and exchanges, packers as buyers and distributors, financing live stock marketing, market reports and news, classes and grades of the principal kinds of live stock, inspection and sanitation, and Government supervision.

Cost of marketing grain, J. E. BOYLE (*Ithaca, N. Y.: Author*, 1922, pp. 24).—Examples are given of the costs of moving certain carloads of grain from

the farmer to the terminal buyer, in which it is indicated that the item of freight is larger than all the tolls taken by other expenses combined. There is included a discussion of the subject of handling grain bought by wire or mail for deferred shipments.

The marketing of mill feeds, G. C. WHEELER (*U. S. Dept. Agr. Bul. 1124* (1922), pp. 20, fig. 1).—The various routes that might be followed in the merchandising of a carload of feed from the mill to the dairyman are described. Some of the important storage arrangements and rates are noted. The handling of feed stuffs by cooperative societies, trade rules, grades, some of the factors controlling prices and facts to be ascertained in connection with prices quoted, some typical phases of feed stuffs laws, and improvements needed in the methods of marketing are set forth.

A study of price control by the U. S. Food Administration, J. C. BARTLEY (*Diss., Catholic Univ. Amer., Washington, D. C., 1922, pp. 139*).—This is a dissertation submitted at the Catholic University of America. The distinction is drawn between price control, price fixing, and rationing. The Federal Food Control Act is outlined, and its special features noted. The remaining chapters are devoted to a detailed study of the food problems with which the Food Administration was concerned during the war. Chapters are given, respectively, to the control of wheat, flour, and bread, sugar, meat and dairy products, and canned goods.

The agricultural bloc, A. CAPPER (*New York: Harcourt, Brace & Co., 1922, pp. VIII+171*).—This is another of the Farmers' Bookshelf series, edited by K. J. Butterfield. It gives an account of the movement resulting in the organization of an agricultural group in Congress, setting forth the attitude of that group toward problems of farm finance, transportation, marketing, co-operation, and protection for agriculture. Four groups of bills were considered of primary importance, and subcommittees were appointed by the group to study amendments to the Federal Reserve Act, plans of commodity financing, transportation and other miscellaneous measures. After the reorganization of the program in 1922 it included the following measures: Farm credits legislation, extending the War Finance Corporation until the need for special credit had passed or new rural credit legislation had been enacted, the truth in fabrics bill, the filled milk legislation, and the Muscle Shoals development plan.

Report of the Irish Agricultural Organization Society, Ltd., for the year ending March 31, 1921, H. PLUNKETT ET AL. (*Irish Agr. Organ. Soc. Rpt., 1921, pp. 151*).—This report continues information previously noted (*E. S. R., 45, p. 897*).

Rural Michigan, L. A. CHASE (*New York: Macmillan Co., 1922, pp. XV+492, pls. 9, figs. 6*).—These pages present an account of the past and present condition of Michigan agriculture and rural life according to a general plan followed in the first of the Rural State and Province Series (*E. S. R., 45, p. 291*). Chapters are devoted to the physical and climatic setting; the influence of soils on the settlement of the State; other resources; the occupation of the land; agricultural industries, plants, and crops; animal industries; transportation and marketing; rural manufactures; rural living conditions; agricultural societies; educational enterprises; governmental work for country life; development of waste lands; and status and tendencies in rural life. Tabulated statistical data are given in appendixes.

Industries in rural districts, E. C. KNY ([*London: Gt. Brit. Development Comm., 1921*], pp. 25).—In this report to the Development Commissioners of Great Britain, the author sets forth the variety of specialization in skill, plant, and organization of rural industry in Germany. He suggests that there is a

field for the development of rural industries in Great Britain, and outlines two organizations, a central intelligence agency and a trading agency, that are deemed necessary for it. Furthermore, he outlines certain procedure to be adopted in the case of training in rural industries for disabled soldiers.

[The agrarian development of France and Germany, 1815-1914], J. H. CLAPHAM (In *The Economic Development of France and Germany, 1815-1914*. Cambridge, Eng.: Univ. Press, 1921, pp. 1-52, 153-231).—These portions of this study in economic history pertain to agriculture and land tenure. The year 1815 is regarded as opening the long period of European peace in the nineteenth century characterized by transformations in landlord and laborer relationships and in the economic condition of the peasants. Chapters are devoted to rural life and agriculture before the railway age in both France and Germany. These describe the several well-defined agricultural areas and the more or less intact remnants of feudalism found in each. The changes in land tenure and ownership effected by the French Revolution, as well as improvements in French agriculture in this period, are described in detail.

The compact village with its open field system is said to have characterized the rural organization of western Germany with certain exceptions, while in the east a manorial system with the servile peasant class prevailed. A gradual movement toward peasant emancipation and general agricultural reform is noted in Germany, coinciding in time with the unsystematic inclosure movement in England.

The years around 1860 are regarded as the turning point in modern French agrarian history. Its development thenceforward is involved with the increased use of machinery, specialized agriculture, tariff policies, cooperation, labor movements, and capitalism, the constant elements since the sixties being the classes of landholders and the size of holdings.

In Germany, 1848 to 1914, the rearrangement of fields and other reforms were carried on systematically. Agricultural tariff policies, cooperation, the development of land and rural credit banks, and the colonization of Poland are discussed.

[The development of Danish agriculture and improvements in the position of the peasants], H. WESTERGAARD (In *Economic Development in Denmark Before and During the World War*. Oxford, Eng.: Clarendon Press; New York: Humphrey Milford, 1922, pp. 3-22, 66-87).—An historical sketch is given in considerable detail.

With regard to Roman agriculture and live stock raising, A. HAUGER (*Zur Römischen Landwirtschaft und Haustierzucht*. Hannover: M. & H. Schaper, 1921, pp. VIII+134, pl. 1, figs. 17).—This descriptive study is based upon the accounts by Latin writers, including Cato, Varro, Maro, Columella, Taurus, and other historians and poets of Rome. It is pointed out what a relatively important industry agriculture was and how large a body of rules and customs were developed, especially along the line of horse breeding. Cattle, swine, sheep, goats, and dogs were the other domestic animals raised.

[Agricultural development in India], T. M. AINSCOUGH (In *General Review of the Conditions and Prospects of British Trade in India During the Fiscal Years 1919-20 and 1920-21*. London: [Gt. Brit.] Dept. Overseas Trade, 1921, pp. 13-23).—The work of the Agricultural Research Institute at Pusa on specific crops and with regard to agricultural problems is noted. Other reports are made on projects for the improvement of agriculture and live stock industries.

Agricultural conditions in the Philippines, 1921, A. PEÑA (*Philippine Agr. Rev.*, 15 (1922), No. 2, pp. 79-148, pls. 17).—Plantings of the principal crops and the distribution of various kinds of live stock in the Philippines in

1921 are mapped, and statistics of production and other agricultural data are tabulated.

Live stock and animal products statistics, 1921 (*Canada Bur. Statist., Live Stock and Anim. Prod. Statist., 1921, pp. 66*).—This is a third of a series, earlier numbers of which have been noted (*E. S. R., 46, p. 293*).

Statistics of the production of cotton in Peru, 1919, J. SILVA SANTISTERAN (*Min. Fomento, Dir. Agr. y Ganadería [Peru], Estadist. Prod. Algodonera, 1919, pp. VIII+5-64*).—Tabulated data showing the area planted and yields per acre are given by departments and principal holdings.

Statistics of the production of sugar cane and cane sugar in Peru, 1919, J. SILVA SANTISTERAN (*Min. Fomento, Dir. Agr. y Ganadería [Peru], Estadist. Prod. Cana Azucar, 1919, pp. IX+[21], fig. 1*).—Annual statistics are given as noted above, with comparisons, but indicating in addition the exports of sugar.

Agriculture and live stock, 1916-1920 (*Norges Off. Statist., 7. ser., 1922, No. 52, pp. [4]+74*).—A statistical summary of agricultural and live stock production in Norway through the five-year period is presented.

[Agricultural statistics of Switzerland, 1920 and 1921] (*Statist. Jahrb. Schweiz, 29 (1920), pp. 98-112, 258-279; 30 (1921), pp. 94-114, 260-276*).—These statistical reports continue information previously noted (*E. S. R., 46, p. 392*).

Agriculture [in Algeria in 1921], T. STEEG (*[Gouv. Gén. Algérie] Exposé Situation Gén. Algérie, 1921, pp. 438-447*).—Notes are given on the later condition and production of important crops (*E. S. R., 45, p. 898*).

AGRICULTURAL EDUCATION.

Supervision of rural schools, K. M. COOK (*U. S. Bur. Ed. Bul. 10 (1922), pp. 111*).—This study is concerned primarily with supervisors and supervision. The questionnaire used in the collection of data included a specific request that distinction be made as between clerical and secretarial assistants and superintendents and professional supervisory assistants. The term "supervision" as used here refers to the work of supervising the schools, whether done by superintendents or supervisors or both.

Part 1 is concerned with the provisions made in the administrative organization for the supervision of rural schools in the different States, whether prescribed by statute or subject to the action of State and local authorities. Information concerning the titles, terms, appointments, and salaries of rural superintendents and supervisors is given in tabular form. Chapter 3 describes the provisions for supervising schools, whether by superintendents alone or with supervisory assistants. Chapter 4 and the tables give a complete account of the selection, terms, salaries, etc., of rural administrative and supervisory officers. A list of States, with the staff of the county departments of education in each county in which supervisory assistants are employed, is given in Appendix A. Much information is compiled from State school laws.

Part 2 relates to methods and results of professional supervision in rural schools as observed by the representative of the Bureau of Education. A few of the systems in which supervision is now being carried on with success and a few of the outstanding characteristics or accomplishments of each are described, the particular systems having been selected either because the type of work was unique, results were accomplished under unfavorable laws, particularly good or especially suggestive methods were used or results secured, or the plan was generally adaptable.

Current problems in home economics instruction and supervision, H. W. CALVIN (*U. S. Bur. Ed., Home Econ. Circ. 14 (1922), pp. 16*).—A series of conferences of supervisors and teachers of home economics in the public schools

was held in 11 principal cities in representative regions of the United States between February 16 and July 6, 1922. The programs for these conferences were prepared from answers to questionnaires sent out to the home economics teachers, the topics which were most often requested in any section being placed upon the program for that section.

Conclusions with regard to the place of home economics in the junior high school, the type of course to be presented, and the amount of time to be allotted to the subject were generally accepted in all of the conferences, and the discussions centered about objectives, organization of work, and projects. They are summarized in these pages.

In regard to senior high school home economics, the general opinion was that semester units of work elective for all girls were more valuable than a fixed sequence of courses open only to those enrolling for the entire curriculum. It was agreed that each half unit of the subject should be so organized as to be complete in itself, and that 60-minute periods given every day with projects having assigned reading and investigation were necessary. Some of the suggested semester courses were on food selection, preparation, and services, based on a good textbook and requiring visits to markets, dairies, bakeries, etc.; costume designing and dressmaking, stressing art, applied design, and the economics of buying; household designs and house furnishings, necessitating visits to houses under construction, plumbing shops, brickyards, etc.; household sanitation and household management; laws affecting the status of women and children; and on the banking customs and the general principles involved in investing savings. Less intensive courses on the purchase and care of wearing apparel; the purchase of ready-cooked foods and the relation of food to health and working efficiency; the management of income; and laws affecting the employed woman are suggested.

It is held that questions of diet for all children of the school may come within the jurisdiction of the home economics teacher. Some of the problems of meeting community needs and establishing community contacts and with regard to rooms and teaching equipment are discussed.

Rooms and equipment for a department of agriculture, S. A. CHALLMAN (*Amer. School Bd. Jour.*, 66 (1923), No. 1, pp. 42, 43, figs. 2).—Two diagrams of floor plans are presented with this article, which is briefly descriptive of the convenient arrangement and equipment of a laboratory and recitation rooms for agriculture for rural schools.

Vocational agricultural education—gains and tendencies, R. W. STIMSON (*Vocat. Ed. Mag.*, 1 (1922), No. 2, pp. 92-96).—Various arrangements for providing projects in agriculture are noted.

Report of joint committees on relationships between extension and vocational education forces in the various States (*Vocat. Ed. Mag.*, 1 (1922), No. 2, pp. 87-92).—A copy of a memorandum sent to directors of extension and to State boards for vocational education and accepted as the basis for establishing special working agreements in the States is given here, with explanations and interpretations by the joint committees of the Association of Land Grant Colleges, the National Society for Vocational Education, the department of rural education of the National Education Association, and the Association for the Advancement of Agricultural Teaching.

Status and results of county agent work, Northern and Western States, 1921, W. A. LLOYD (*U. S. Dept. Agr., Dept. Circ. 244* (1922), pp. 42, figs. 14).—This circular is the last of a series of reports giving regional consideration to county agent work. Discussion is given of relationships, State programs, demonstrations and visits, maintenance and training of personnel and extension workers, and activities of county agents with reference to farm economics and marketing, boys' and girls' clubs, and home demonstration work. Concrete

examples of accomplishments are related, and statistical tables summarizing the various lines of county agent work carried out in 1920 and 1921 are given in the appendix, as well as the text of the memorandum of understanding of April 22, 1921, between the executive committee of the American Farm Bureau Federation and the States Relations Service, relative to farm bureaus and the extension service.

Report of the minister of agriculture for the Province of Quebec, 1921-22 (*Rap. Min. Agr. Prov. Quebec, 1921-22, pp. XVI+231, pls. 24, fig. 1*).—Reports are submitted here from a number of agricultural schools and services.

The agricultural instruction grant in British Columbia (*Agr. Gaz. Canada, 9 (1922), No. 6, pp. 485-496*).—This summary of activities, 1913-1922, is presented in three parts, dealing, respectively, with the work of the department of agriculture; elementary agricultural education, reported by J. W. Gibson; and investigations carried on by the University of British Columbia.

The school of agriculture of the University of Cambridge, T. B. WOOD (*Jour. Min. Agr. [London], 29 (1922), Nos. 3, pp. 223-230; 4, pp. 296-302, pls. 2*).—A member of the faculty relates the history of the development of this school.

The National Institute of Agricultural Botany, W. H. PARKER (*Jour. Min. Agr. [London], 28 (1922), No. 12, pp. 1072-1084, pl. 1*).—The organization and functions of this institute, previously noted (*E. S. R.*, 46, p. 398), are described.

Farm institutes (*Jour. Min. Agr. [London], 29 (1922), Nos. 5, pp. 400-408, pls. 2; 6, pp. 510-518, pl. 1*).—A summary is given of the training provided at eight farm institutes in England.

An agricultural club on the plateau of Roumois, G. JANNIN (*Jour. Agr. Prat.*, 38 (1922), No. 36, pp. 213-215, figs. 3).—The floor plan of a motion-picture theater and a community building at Thelllement (Eure), France, is given here, with a description of its equipment and uses by the rural population.

The Third National Congress of Agriculture and Live-stock Raising (*3. Congresso Nacional de Agricultura e Pecuária. Comissão Organizadora, Estatutos, Programma. Rio de Janeiro: Soc. Nac. Agr., 1922, pp. 32*).—This gives the statutes organizing this congress, which held its meetings in September, 1922, at Rio de Janeiro, and a program for the discussion of the particular problems relating to agriculture, animal industry, agricultural education, and credit is outlined in 75 topics.

A primer for the agriculturist, F. LOBIA (*Cartilla del Agricultor. Principios de Economía Rural. Mexico: Casa Unida de Publicaciones, 1922, pp. 163, pls. 5, figs. 29*).—Elementary principles of crop production, the essential farm equipment, and farm organization are set forth here.

First book of grasses, A. CHASE (*New York: Macmillan Co., 1922, pp. XIII+121, figs. 94*).—This primer consists of 12 lessons graded from the simplest to the most complex, each lesson being accompanied by figures bringing out the facts in the text. Grasses of the United States are used for the lessons, and the commoner ones have been selected so far as possible. On account of the wide range in the native grasses, the principles laid down are applicable to the subject in general.

Farm mechanics, F. D. CRAWSHAW and E. W. LEHMANN (*Peoria, Ill.: Manual Arts Press, 1922, pp. 423, figs. 408*).—This is designed to meet the need for a textbook on mechanical processes for use by teachers of vocational agriculture in agricultural high schools and colleges. Each part deals exclusively with one particular type of work, as woodwork, cement work, forging, etc. The projects are selected from the standpoint of the practical application to the needs of the student, and the gradation of projects within each of the parts has

been kept in mind. Working drawings and specifications for many of them have been given. Many supplementary projects are suggested.

The romance of Everifarm, H. J. SCONCE (*New York: Macmillan Co., 1922*, pp. XII+11-163, pls. 31).—This is a nature study in narrative form of the animals and plants on the farm and in the surrounding woodlands, both pests and benefactors of the farmer, concluding with a chapter about *Fusarium* of wheat.

MTSCCELLANEOUS.

Report of Hawaii Station, 1921, J. M. WESTGATE ET AL. (*Hawaii Sta. Rpt. 1921*, pp. V+65, pls. 10).—This contains the organization list, a summary by the agronomist in charge as to the work of the year, and reports of the divisions of horticulture, agronomy, chemistry, and extension, home demonstration activities, the extension and demonstration work on the island of Hawaii, and of the Hailu and Haleakala Substations. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Report of Northwest Experiment Station, Crookston, 1921, C. G. SELVIG (*Minnesota Sta., Crookston Substa. Rpt. 1921*, pp. 76).—The experimental work reported is for the most part abstracted elsewhere in this issue.

Report of Northeast Demonstration Farm and Experiment Station, Duluth, 1921, M. J. THOMPSON (*Minnesota Sta., Duluth Substa. Rpt. 1921*, pp. 34, figs. 9).—The experimental work reported is for the most part abstracted elsewhere in this issue.

Report of West Central Experiment Station, Morris, 1921, P. E. MILLER (*Minnesota Sta., Morris Substa. Rpt. 1921*, pp. 43).—The experimental work reported is for the most part abstracted elsewhere in this issue.

Annual Report of New Jersey Stations, 1921, J. G. LIPMAN ET AL. (*New Jersey Stas. Rpt. 1921*, pp. XXXI+475, pls. 18, figs. 14).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1921, a report of the director on the work and publications of the year, and departmental reports, the experimental features of which, not previously reported, are for the most part abstracted elsewhere in this issue. An extensive report of the division of extension in agriculture and home economics, containing considerable data pertaining to demonstration work, is also included (pp. 173-259).

Report of the Virgin Islands Station, 1921, L. SMITH and C. E. WILSON (*Virgin Islands Sta. Rpt. 1921*, pp. IV+24, pls. 3).—This includes the organization list, and a report by the agronomist in charge as to the work of the station for the fiscal year ended June 30, 1921. A report of the entomologist is included. The experimental work reported is for the most part abstracted elsewhere in this issue.

Bulletin summary (*Massachusetts Sta. Circls. 68-69 (1922)*, pp. 6 each).—The first of these two circulars consists of brief summaries of Bulletins 201-206, Technical Bulletin 4, and Control Series Bulletins 15-17, all of which have been previously noted. The second consists of similar summaries of Bulletins 207 and 208, and Control Series Bulletin 18, previously noted, and of Bulletins 209 and 210, and Technical Bulletin 5, abstracted elsewhere in this issue, as well as a list of available station bulletins and extension leaflets issued during 1922.

Quarterly Bulletin of the Michigan Experiment Station, edited by R. S. SHAW and E. B. HILL (*Michigan Sta. Quart. Bul. 5 (1922)*, No. 2, pp. 50-86, figs. 16).—In addition to articles abstracted elsewhere in this issue, this number contains the following: Abortion and Sterility in Cattle, by E. T. Hallman; Great Alfalfa Increase, by J. F. Cox; Official Cow Testing in Michigan, by E. B. Hint; and Blackhead of Poultry, by H. J. Stafseth.

NOTES.

New Jersey College and Stations.—The poultry husbandry building which was completed last August was formally dedicated November 25, 1922. A large number of poultrymen who had been instrumental in procuring the appropriation for the building were present. Speakers included H. R. Lewis, formerly head of the poultry department; H. O. Packard, president of the State Poultry Association; Dr. Walter T. Marvin, dean of the university faculty; Dr. J. G. Lipman, dean of the college of agriculture and director of the stations; and Hon. Newton H. Porter, president of the State chamber of commerce.

Plans are nearly completed for the dairy and animal husbandry building, and it is expected that ground will be broken for this structure by spring.

A special 2-year course in agriculture is being offered in cooperation with the rehabilitation division of the U. S. Veterans Bureau. The major course is to be poultry husbandry, and the initial enrollment is 34.

The short courses in agriculture opened with an enrollment of 116. Of this number 37 are in the course in general agriculture and dairy farming, 28 in fruit growing and market gardening, and 51 in poultry husbandry.

John W. Bartlett, field secretary of the New Jersey Holstein-Friesian Association, has been appointed dairy husbandman in the stations and assistant professor of dairy husbandry in the college, vice W. M. Regan, beginning December 1, 1922. Howard F. Huber, for the past three years vegetable production manager for a firm at Bridgeton, N. J., has been appointed instructor in vegetable gardening in the college and assistant olericulturist in the stations.

New York State Station.—N. F. True, assistant chemist, resigned April 1 to engage in commercial work in Indiana.

Oklahoma College.—E. A. Miller, professor of rural economics and sociology, has been appointed director of extension vice W. A. Conner, effective January 1.

Texas College and Station.—Dr. George F. Freeman, chief of the division of cotton breeding, sailed recently for Indo-China where he will serve on a commission to investigate the cotton growing possibilities of that country for the French Colonial Company, a government endowed corporation for the development of French colonial possibilities. A six months' leave of absence dating from March 1 has been granted, which may be extended another six months if desired. Dr. E. P. Humbert, formerly in charge of the cotton breeding work and at present professor of genetics in the college, will serve as acting chief of the division during Dr. Freeman's absence.

Hawaiian Pineapple Cannery Experiment Station.—On January 1, 1923, the pineapple work of the Hawaiian Sugar Planters Association was organized as a separate institution to be known as the Experiment Station of the Association of Hawaiian Pineapple Canneries. R. E. Doty has been appointed director of the station, whose address is Wahiawa, Oahu, T. H.

Experimental Farm at Canton Christian College.—The Canton Christian College has acquired a tract of land near Chaochowfu, China, for use by the

College of Agriculture as a modern experimental farm. At this farm efforts will be made to improve the fruits, vegetables, and field crops of the locality, and especially to promote the growing of citrus fruits. A canning factory will be started and silk culture begun. The growing of sugar cane will be another special feature, and a refining plant erected on the tract many years ago is being reconstructed. Attention will also be given to dairying.

First National Agricultural Convention in China.—An account is given in a recent issue of *World Agriculture* of this convention, which was held at Tsinan, Shantung Province, from July 4 to 8, 1922. Seventeen of the 18 provinces of China were represented by 174 delegates, including several from the Central Government.

It is of interest to note that of 102 proposals considered by the convention, 21 concerned agricultural education and 22 agricultural experimentation. An executive committee of 11 members headed by P. W. Tsou, dean of the College of Agriculture of Southeastern University, Nanking, as chairman, and Chang-Shan Dao, director of the Central Experiment Station, Peking, as vice chairman, was appointed. At the subsequent meeting of this committee plans for a permanent organization were effected and a meeting scheduled to be held at Tsi-Hua College, Peking, during the next summer.

An agricultural exhibition was also held under the auspices of the convention. Exhibits from 35 organizations of 5 provinces were shown, including statistics, drawings, collections, models, publications, farm implements, etc.

World's Dairy Congress.—Announcement is made of the decision to hold this congress in Washington, D. C., October 2-5. The National Dairy Show is to be held at Syracuse, N. Y., October 6-13.

American Society of Animal Production.—The annual meeting of this society, held at Chicago on December 1 and 2, 1922, was opened with an address by Dean W. C. Coffey, the retiring president, in which the live stock conditions and developments of the year were discussed.

A very full program was presented along both animal production and genetics lines. In the former group the papers included the following: Minerals for Fattening Pigs and for Developing Breeding Gilts on Pasture, by J. M. Evvard, C. C. Culbertson, and W. E. Hammond; The Net Protein Values of Feeds and Food Materials, by H. H. Mitchell; The Digestibility of Cattle Feed, by J. A. Fries; Practical Experiments on Feeding Rations with Different Calcium Content to Dairy Cows, by E. B. Meigs; Alfalfa Hay as a Basis for Home-grown Rations for Milk Production, by R. S. Hulce; The Effect of Winter Rations upon Summer Pasture Gains of Steers, by C. W. McCampbell and E. W. Sheets; Great Families and Individuals of the Hereford Breed, by R. E. Hunt; Beet By-products as Feeds for Steers and Lambs, by E. J. Maynard; Sunflower and Corn Silage for Feeding Steers, by F. W. Christensen; Government Supervision of Live Stock Markets, by W. A. Williams; Clover Hay v. Oat Straw When Fed with Corn, Corn Silage, and Cottonseed Meal for Lambs, by F. G. King; Yellow Corn v. White Corn for Live Stock, by F. B. Morrison; The Relation of Fairs to Live Stock Improvement, by E. N. Wentworth and R. Weimer; Significance of Balance in Animal Production, by W. J. Fraser; Results of Investigations in the Treatment of Stomach Worms in Sheep, by G. H. Lamson; and The Effect of Prolonged Maintenance on Subsequent Growth and Development in Pigs, by W. E. Carroll.

The papers on genetics included Some Genetic Experiments Carried on by the Animal Husbandry Department of the Kansas State Agricultural College, by H. L. Ibsen; Genetics in Practical Live Stock Breeding, by E. G. Ritzman; The Inheritance of Milk Yield and Some of Its Practical Applications, by J. W. Gowen; Correlation of Head Length with Certain Other Measurements

in Holstein-Friesian Cattle, by B. E. Pontius; The Influence of Age and Individuality on the Yield of Wool, by J. L. Lush; Results of Investigations of Sterility in Males, and Influence of a Great Sire on a Breed, both by W. S. Anderson; The Inheritance of Percentage Fat Content in Dairy Cattle, by W. L. Gaines; and Can Sex be Controlled? by M. A. Jull.

E. B. Forbes, chairman of the committee on methods of research, presented a voluminous report which is to be printed. E. W. Sheets discussed the proposed membership of the society in the Federation of Biological Societies, and it was voted to join with the federation provided all members of the federation receive an equal representation. The proposition of a journal to be published by the society was also brought up for discussion and referred to a committee for consideration.

The officers elected for the coming year were president, F. G. King of Purdue University; vice president, G. Bohstedt of the Ohio Experiment Station; and secretary-treasurer, E. W. Sheets of the Division of Animal Husbandry, U. S. Department of Agriculture.

On December 3 a dinner was given in honor of Dean H. L. Russell at the Saddle and Sirloin Club, with Dean W. C. Coffey as toastmaster. Speeches were given by Dean Russell, several of his former students and associates, and by officers of the club in which the early history and development of the Wisconsin Experiment Station were described, special reference being made to the assistance given to this work by Dean Russell. A portrait of Dr. Russell was also presented to the Saddle and Sirloin Club for their gallery.

Necrology.—Dr. Bernhard E. Fernow, one of the pioneer authors and educators in forestry in this country and the first head of the forestry work of the U. S. Department of Agriculture, died at Toronto February 6 at the age of 72 years.

Dr. Fernow was a native of Germany, studying under a number of noted foresters of that country. On coming to the United States in 1876 he became active in formulating legislation establishing the New York State Forest Reserve in the Adirondacks. Ten years later he became organizer and director of the forestry work of the U. S. Department of Agriculture, continuing in this service until 1898 when he was called to Cornell University to organize the first forestry school in America. Upon the discontinuance of this school in 1903, he spent four years as a consulting forester and editor of the *Forestry Quarterly*, and organized the forestry work of the Pennsylvania State College. In 1907 he organized the first forestry school in Canada at the University of Toronto, and at the time of his death was professor emeritus.

Dr. Fernow was widely known as a lecturer and writer, his best-known work being the *History of Forestry*.

Alfred Koch, director of the Institute of Agricultural Bacteriology of the University of Göttingen, died June 22, 1922. He was born November 8, 1858, at Erfurt, and studied at the universities of Strasburg and Berlin from 1879 to 1883. Subsequent work at Strasburg under De Bary turned his attention and interest to the science of bacteriology. In 1886 he was appointed assistant in the Institute of Plant Physiology at Göttingen, and in 1888 when admitted to the faculty he already was recognized as an authority on bacteriology and fermentation. After the pursuit of viticultural studies at Geisenheim in 1894, Koch left Göttingen to teach in the viticultural school at Oppenheim. In 1901 he returned to Göttingen to accept a full professorship at the university and to become director of the newly established Institute of Agricultural Bacteriology, the first institute of its kind in Germany. In these positions he remained active until his death.

Mrs. Thetis Clay Hatch, widow of Hon. William H. Hatch of Missouri, author of the Hatch Act for the establishment of agricultural experiment stations, died at Hannibal, Mo., February 6 at the age of 79 years. An only daughter, Miss Sallie Rores Hatch, survives her.

Celebration of the Eightieth Anniversary of Dr. Wagner.—On March 7 the noted German agricultural chemist and investigator, Dr. Paul Wagner, of Darmstadt, completed his eightieth year, the event being observed by his numerous friends and former students in Germany in a celebration held at Darmstadt in his honor.

More than 50 years ago Dr. Wagner became director of the Darmstadt Experiment Station, founded in 1871, and has since won for that institution world-wide distinction through his investigations on the effects and value of different kinds of fertilizers, and especially through his efforts to develop exact methods of making such investigations.

Recognizing the weaknesses of field experiments as a means of exact investigation, he undertook to perfect a method of pot cultures (using both water-tight pots and sunken cylinders) to supplement and supply the deficiencies of field experiments. This method, or modifications of it, has been widely and successfully used by investigators.

Wagner's work and publications have contributed largely toward securing the efficient use of fertilizers. He was among the first to recognize and correctly estimate the fertilizing value of Thomas phosphate or basic slag; and the fertilizing value of other phosphates, nitrogen compounds, potash salts, and manure have been extensively studied by him.

His numerous contributions have been noted from time to time in the *Record*. Accounts of the Darmstadt Experiment Station and the Wagner Method of Pot Culture, by J. B. Lindsey, have also appeared (*E. S. R.*, 7, pp. 3, 77).

Soy Bean Nomenclature.—At a meeting held at Columbia, Mo., September 1, 1922, recommendations were formulated by the committee on soy bean nomenclature of the National Soy Bean Growers' Association as to varietal nomenclature. These recommendations are that the name Midwest be employed instead of Mongol, Medium Yellow, Northern Hollybrook, Roosevelt, and Banner; Ito San for Ito San, Medium Early Yellow, and Early Yellow; Wisconsin Black for Wisconsin Black, Wisconsin Early Black, Wisconsin Pedigreed Black, and Early Wisconsin Black; Peking for Peking, Sable, and Essex; and Ebony for Ebony and Black Beauty. Further recommendations are that each member of the committee shall, through the extension and county agent service and through the seedsmen of his State, endeavor to establish the names recommended.

To ascertain whether a new variety is a new and valuable sort and to avoid a duplication of names, any name to be given a new variety is to be submitted to the chairman of the committee on nomenclature, together with seed and a description of the plant.

ADDITIONAL COPIES
OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.

AT
10 CENTS PER COPY
SUBSCRIPTION PRICE, 75 CENTS PER VOLUME

PURCHASER AGREES NOT TO RESELL OR DISTRIBUTE THIS
COPY FOR PROFIT.—PUB. RES. 57, APPROVED MAY 11, 1922

EXPERIMENT STATION RECORD.

i VOL. 48.

APRIL, 1923.

No. 5.

The lives of really great men are a powerful influence in the world, not only for those of their time but often quite as much for those who come after. Apart from their material accomplishments, this is true of the great figures who have brought about notable advances in civilization, in literature, in art, and in science. It is one reason why the study of their characters and careers is a part of preparation for an appreciative and productive life. It is also a reason why their anniversaries are widely observed—not alone to honor their memories but to bring to light anew what their lives have taught and given us, to revive their influence and to draw again from their inspiration.

Such a great figure was Louis Pasteur, the centenary of whose birth is being observed throughout the world. To most, the story of his life and achievements is not new. It bears repetition, however, because of its intense interest to all who care for science, and especially on account of the great lessons it carries for to-day. These legacies from his life and work can never become old and unprofitable to consider, they are so fundamental and enduring. As Duclaux said of him, "he is always worthy of admiration, and worthy also to serve as an example." It would indeed be difficult to find a character around which the ideals of research and the qualities which typify the man of science could better be woven.

If any excuse were needed for reference to this man in this place, it would be found in the close relations of his studies to agriculture and the application of his ideals and methods to research in that field. This is a side usually neglected in measuring his influence and assigning the effects of his labors. But undeniably he may be claimed in part by agriculture, for some of his most fundamental and far-reaching studies had their roots in agricultural problems, and few men have opened the door wider or had a more vital influence in the development of science in relation to that industry.

Agriculture was not only the most direct beneficiary of his early work, but it was out of his investigations in that field that their broader applications to human pathology and to the industries developed. It is only necessary to recall his studies on fermentation in wine and vinegar making, on the serious troubles of silk worm culture, and on several diseases of live stock from which resulted some of his most epoch-making advances in science.

The problems of the farming people appealed to him strongly, and his interest was heightened by his great desire to be useful. Several of his important lines of study were carried out under the auspices of the Ministry of Agriculture, while others had their origin in observance of the difficulties from which agriculture was suffering. In sericulture alone the losses in twenty years before Pasteur found a practical way to avoid two ravaging diseases are stated to have amounted to \$300,000,000. The dread disease of anthrax or splenic fever, against which the farmers were practically powerless, was causing an annual loss of three million francs in one department alone. In discovering the cause and means of control he made one of the most fundamental additions to the etiology of disease; and in staging an extensive experiment in this on a large farm under the auspices of an agricultural society, he not only convinced his audience of the reliability of his procedure, but compelled acceptance of his theory of protective vaccination, one of his greatest triumphs. His work with fowl cholera resulted in the discovery of vaccine, which opened up a new world in combating infectious diseases. Huxley said of his studies in fermentations that they saved France more than enough to cover the indemnity of the Franco-Prussian war.

We may think of Pasteur, then, in relation to his service to agriculture and his influence on the progress of agricultural investigation. This relation was recognized in his own time. He was urged to accept the chair of agricultural chemistry at Pisa, which he declined for patriotic reasons; he was called to lecture before agricultural societies, and he was urged for senator by an agricultural constituency. The French Agricultural Society awarded him a medal for his work on anthrax, and the agricultural society before which his famous anthrax experiment was performed had a medal struck "in commemoration of one of the greatest services ever rendered by science to agriculture". Another followed with a similar recognition of his service to sericulture, while at least three other bodies presented testimonials of their gratitude for his aid to agriculture.

So it was not alone scientific academies and ultimately his government which honored him so highly, but the farmers of the country

who acknowledged their great debt to him and in their less imposing way brought their grateful tributes.

The life of this great figure appeals to the average man because in the beginning he was much like the rest of us. He did not come from a line of scholars; as is familiarly known, his ancestry was an humble one. His father, grandfather, and great-grandfather were tanners, and his mother was the daughter of a gardener, accustomed to work in the fields. They were poor but high-minded, hard working people. He himself was not precocious and in his school days was described as only a good average pupil. He entered the Superior Normal School in Paris only after the second trial. But he was a persistent student; he loved books and had a deep seated desire for knowledge, and he had an ambition and enthusiasm which fired him all along his career.

It is these things that make his character the more interesting. Everyone might profitably read again the fascinating story of his life. It was not all a course of achievement and success; it had its share of sadness, disappointment, and temporary discouragement, and it was crossed repeatedly by the most intense skepticism and jealousy. How could it be otherwise, when such radical pronouncements and reversals of established beliefs disturbing the conventional trend of thought were being enunciated?

Work was one of his ruling passions, because he believed that properly directed it would bring success. "When one has learned to work," he wrote, "he can not live without it." He loved it, and he gave up everything else for it. To the students at Edinburgh he said: "Work perseveringly; work can be made into a pleasure, and alone is profitable to man, to his locality, to his country." He declared that nothing he ever accomplished came except through hard work. Every step of progress was painfully acquired. "We must never be satisfied with what we have already accomplished," he said, but press forward to other things, for it was his philosophy that "duty ceases only when ability to labor is at an end." In a toast to science he exclaimed: "Let us strive, for strife is effort, strife is life when progress is the goal."

He had little belief in mere chance. To one who suggested it, he replied that "chance favors only those who are prepared to take advantage of it." Close application, patience, and perseverance were his alternatives.

Progress was his constant watchword. He often said, "Do not dwell on things already acquired", and he exemplified this throughout his career. It represented the expanding of his mind with each successive step. One discovery paved the way for another. The study of ferments led to the discovery of anaerobes and enabled him

to explain the decay or dissolution of organic matter,—not as a process of death, as had been claimed, but as the work of teeming life, associated with the activity and multiplication of living organisms. If these phenomena were due to life, what was the source of these living agents? This query led him to the study of the air as a carrier of germs, explaining many things, and thence into the complex field of spontaneous generation. The fact that his colleagues considered the latter subject all too difficult and dangerous, too sure to involve him in violent controversy, did not deter him; and although his disproof of that fallacy brought upon him vigorous attack and opposition, eventually he convinced the most skeptical by the sheer force of his plain and incontrovertible experiments.

He had the advantage of many of his day in that his method, as opposed to vague conception and a priori speculation, was based on carefully conceived and controlled experiments, interpreted with calm, unbiased judgment. He had a supreme faith in the experimental method. He devoted infinite pains to details of observation, exercised his ingenuity in building upon them other tests, and endeavored to foresee and avoid causes of error, the whole process leading up to clear and decisive experiments which would settle a point definitely or prepare the way for the next step. He not only planned and executed his experiments with skill and ingenuity but, as he said, he tried to understand what they taught him. As Tyndall expressed it, he had an extraordinary faculty for combining facts with the reasons for those facts. The venerable academician Biot declared that he illuminated everything he touched.

Argument and contention meant nothing to him unless backed up by conclusive evidence. He had little patience when this was lacking, and sometimes declared of his opponents that they did not know how to experiment; but on the other hand, in combating doubt and skepticism he willingly gave his time and ingenuity to devising experiments that should be so clear and direct as to be indisputable. For example, when he described the air as the source of the organisms inducing fermentation in wine, which adhered to the grapes at certain stages, he met the objection of his opponents by carrying out experiments in which grapes were wrapped in cotton to protect them and compared with those left exposed, showing that not one of the former produced alcoholic fermentation while the latter induced it in abundance.

Criticism played no unimportant part in Pasteur's scientific career. Exacting in his own work, he expected that of others to stand the same rigorous test. He is described as implacable in his criticism of his own hypotheses, often working for months to assure

himself he was not a prey to error. One of his biographers has explained that when his intuition and his vivid imagination had carried him to a summit from which a broad horizon seemed spread out before him, with a violent effort he would doubt his imagination, resolutely force his mind to start again along the path of the experimental method, and slowly, surely, gathering proofs as he went, he would again work his way up to the advanced position. "In experimental science," he wrote, "it is always a mistake not to doubt when the facts do not compel one to affirm."

With no lack of courage, he said of himself: "I am the most hesitating of men, the most fearful of responsibility, so long as I am not in possession of the proof. But when solid scientific proofs confirm my convictions no consideration can prevent me from defending what I hold to be true." In cautioning against allowing personal bias to influence conclusions, he wrote: "The greatest disorder of the mind is to allow the will to direct the belief."

In the closing years of his life, in a memorable address, he advised his colleagues to keep their early enthusiasm, but to let it ever be regulated by rigorous examinations and tests, never to announce anything which could not be proved in a simple and decisive fashion, and to worship the spirit of criticism.

The great investigator himself courted criticism, and on one occasion, when he was working on chicken cholera and attenuation, he wrote to a friend: "Do repeat to me every criticism you hear; I much prefer it to praise, barren unless encouragement is wanted, which is certainly not my case; I have a lasting provision of faith and fire."

His desire for criticism was gratified in full measure. No man of science ever had to meet more persistent skepticism and violent opposition. This was true all along the course of his career—in combating silkworm diseases, in formulating the nature and cause of fermentation, in the application of his germ theory, in the making of vinegar, wine, beer and alcohol, and especially in propagating his theories of the nature and dissemination of epidemics and the means of controlling them. The attacks and charges waged long after each great discovery. He was referred to as "a mere chemist"; was accused of suppressing unfavorable results, even of dishonesty and charlatanism in his experimental demonstrations; and many of these attacks came from medical men and veterinarians and from fellow-academicians. His treatment for hydrophobia brought upon him most vigorous onslaught. Anonymous letters were sent to him; insulting newspaper articles were published, "all that envy and hatred could invent."

But he had the great advantage of having the evidence on his side and of being able to present it in a way that compelled assent,

although opposition died hard. "I am not content with giving you convincing experiments which always succeed," he wrote. "I do more than that. I explain why my predecessors have so often obtained those contradictory results which have troubled them and stayed their decisions." He was a powerful antagonist because he refrained from taking a definite stand until he was sure of his ground, and then he did not hesitate to answer his opponents with a force that could not be overthrown.

The vigor of his controversies he explained as the desire to dispel the scientific fallacies which prevailed, and through scrupulous accuracy in experiment and clear reasoning to develop the truth. But he often declared that these discussions were wholly impersonal; "we are all actuated by a supreme passion, that of progress and of truth." On one occasion in defending his critical attitude he explained: "If I have sometimes disturbed the calm of our academies by somewhat violent discussion, it was because I was passionately defending truth." His desire to carry conviction was expressed in his remark that "the recompense and the ambition of a scientist is to conquer the approbation of his peers and of the masters whom he venerates."

His love of light was not for the reflection of it upon himself, for modesty was a strong characteristic, or alone for the glory of science, but for the good it would do. With all his passion for knowledge and his love of science, it was what it would contribute to the world and humanity that most moved him. His great desire, so oft repeated as his work advanced, was to turn science to usefulness, to aid humanity through it. Speaking of the satisfaction of a successful career in science, he declared that great as is the gratification of an investigator in making new discoveries, "his cup of joy is full when the result of his observations is put to immediate practical use."

"Let us always make application our object," he wrote, "but resting on the stern and solid basis of scientific principles. Without those principles application is nothing more than a series of receipts, and constitutes merely empirical routine. Progress with routine is possible but desperately slow." And he developed those principles with an eye to their applications and to more intelligent practice.

Theory was to him a means to an end, in research as well as in relation to practical affairs. He looked upon the test of theories as their fruitfulness. "A theoretical discovery has but the merit of its existence; it awakens hope, and that is all. But let it be cultivated, let it grow, and you will see what it will become." Of theory in relation to practice he said: "Without theory practice is but routine born of habit. Theory alone can bring forth and develop the spirit

of invention." He believed that "of all the nations, that one will always be foremost which shall be first to progress by the labors of thought and of intelligence." This goal of "progress by the labors of thought and intelligence" is one which has so largely inspired agricultural investigators of the present day.

What were the secrets of success in this remarkably productive life—what traits that may serve as an example to the investigator of today? Pasteur modestly attributed his success to "assiduous work, with no special gift but perseverance joined to an attraction toward all that is great and good." These were powerful qualities, but if we may believe his biographers and the evidences of his study, there were others which stood out prominently. To a large extent they were acquired. Some of them may be mentioned.

Thorough preparation: He laid the foundation for his work in this, and he never ceased to supplement it. He continued growing. He studied under men who were masters and sought intellectual association with the best minds. This in part was responsible for his unusual breadth and versatility. His early work was done in pure chemistry and crystallography, from which his course led through fermentations to diseases and their etiology, with epoch-making contributions to bacteriology and immunology, consummated in his classic work on rabies.

Purpose: He had a definite goal. It was to acquire new knowledge which would not only add to the sum total but be useful to humanity. This gave purpose and direction to his labors, made them constructive and progressive, gave zest to each successive piece of investigation.

Continuity: He followed through to a finish, even though he met with temporary failures which made it necessary to go all over the ground again. It is said that he never abandoned a subject but was ever ready to begin again after a failure. He devised new experiments, sought a different method of approach, and he studied the results attentively as he went along to see what they were developing. They must be productive, for the routine accumulation of data after they had ceased to shed light had no place in his program. He required that his work should be definitely constructive. He wasted little time on things already acquired. He advanced by successive steps on the basis of studies which, while diverse in character and covering a broad field, were clearly connected and supported one another.

Interest in his work: His love of work has been referred to. His devotion to it was accounted for in no small measure by an intense interest in what he was doing. He was absorbed in it for the time

being. This was one secret of success, for work without an interest which calls forth the best there is in one is likely to go little beyond routine. He looked upon work as an opportunity, for he had a high sense of duty, and he saw in accomplishment a means of meeting the responsibility for his education and the facilities given him, for bringing honor to his country, and for giving aid to humanity. What he had been able to accomplish, instead of resulting in complacent satisfaction and diminished vigor, only opened the door wider to his fertile imagination and stimulated him to further undertakings.

Intensity: His concentration of effort and close application, the absorption with which he devoted himself to the work in hand, were striking qualities acquired from his youth. He worked on many things, but he never scattered. His effort was systematic and thorough to the last degree which his critical attitude and his ingenuity could make it. How severe a taskmaster he was is shown by his remark on one occasion in which he doubted the truth of the facts in question: "In order to disperse those doubts I have instituted the most numerous and varied experiments, and I have not succeeded through four months in satisfying myself by irrefrangible proofs. I still have my doubts."

Keeness of observation: Habit made him a keen and penetrating observer. Nothing however trivial which might bear on his studies seemed to escape him. Puzzled over the spread of anthrax and whether the germs from a buried carcass returned to the surface, and how, he noticed one day in the field where he was experimenting a difference in color of a patch of soil. Inquiry developed that sheep dead of anthrax had been buried there the preceding year, and closer examination of the soil suggested the deposits of earthworms. This trivial observation which might easily have escaped a less practiced eye led to the discovery of the earthworm as an agent in bringing the germs of this disease to the surface, and supplied another important link in the obscure question of control.

Penetration: He not only observed and recorded what he saw, but he studied over it. He never stopped with the bare fact; it stimulated his further curiosity and fired his imagination. He tried to make out its significance—what it meant or what it might teach him. He owed his power of penetration in no small part to his habit of following through the facts that his keen observation disclosed. It was responsible for some of his largest discoveries. For example, in the routine of testing cultures of fowl cholera, the constancy of the virulence was interrupted one day when an overlooked culture a few weeks old was used, the inoculated hens becoming ill but recovering. Instead of attributing this to chance or a possible ex-

perimental error and passing it over, these hens were inoculated with fresh cultures and found to be resistant. Not content with this fact the cause was sought—what had happened to these cultures heretofore uniform in their action? Investigation developed that the change was due to oxygen, and that by varying the age of a culture the mortality was correspondingly varied, until at length it failed to produce death. The virulence of the variously attenuated cultures was found to be reproduced in other cultures propagated from them, and non-virulent cultures reproduced non-virulent ones. The long hoped for production of a protective vaccine had thus been accomplished!

Independence of thought: He cultivated the habit of independent thinking. He was not blinded by the accepted belief of others. He demanded clear, unequivocal evidence. He did not hesitate to think both Liebig and Berzelius, the two most eminent chemists of the day, might be wrong, and his questioning led to the discovery of the principles of fermentation and recognition of the real nature of ferments.

Undismayed by circumstances: He made the most of his opportunities and minimized the handicaps. When he was called to the Superior Normal School in Paris he had only the most meager laboratory facilities—two attic rooms under the roof which he adapted to his purpose, so hot in summer that sometimes he had reluctantly to suspend his studies. He was allowed no assistance of any kind, not even an ordinary laboratory attendant, and no grants for the maintenance of investigation. Such conditions would have discouraged many with fainter heart for research, but he had an indomitable will and so accepted them, financed the laboratory from his own pocket or with the aid of friends, and in this period laid the foundation for his recognition. To a friend who was struggling against similar hindrances he wrote: "Let it stimulate and not discourage us. Our discoveries will have the greater merit."

In his forty-sixth year, when his work was going on with the greatest intensity, he suffered a cerebral hemorrhage, resulting in paralysis of the left side. This was followed by a long and anxious illness. But his soul was unconquered. Recovery left him with a limp in his left leg and a stiffness of his hand, obliging him to leave the carrying out of his experiments quite largely to his assistants. With mind unimpaired, "undismayed and thrice determined," he continued work for twenty-five years and made that period one of the most productive of his whole life.

Did Pasteur have a project? The evidence is that he did—several of them. His purpose was clear-cut, and the theory on which his

plan was based was a result of careful analysis and clear thinking, developed in the light of what he found. His procedure involved a severe regimen, systematic and methodical, each step fortified by experimental proof. Frequently his program was written out in considerable detail; and the project was followed through to a finish, even though it might require a long time, the end in view never being lost sight of. In addition, he made his reports of progress in the form of communications to the academies when an important development had been reached. More is not involved in the project of today.

The high idealism expressed in the life of this great man is well set forth in his charge to students on the occasion of his seventieth birthday celebration. "Young men," he said, "have confidence in those powerful and safe methods of which we know not yet all the secrets. And whatever your career may be, do not let yourselves become tainted by a deprecating and barren skepticism. Do not let yourselves be discouraged by the sadness of certain hours which pass over nations. Live in the supreme peace of laboratories and libraries. Ask yourselves first 'What have I done to repay my education?' and as you gradually advance, 'What have I done for my country?' until finally you may have the immense satisfaction of knowing that you have contributed in some measure to the progress and well being of humanity. But whether your efforts are more or less favored by life, be able to say when you approach the great end, 'I have done what I could.'"

Confidence, optimism, courage, and industry, all qualities which may be acquired. The life of Pasteur illustrates what these may accomplish when guided by love of service.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Catalysis in organic chemistry, P. SABATIER, trans. by E. E. REID (*New York: D. Van Nostrand Co., 1922, pp. XXIV+406, fig. 1*)—This is an English translation of the volume previously noted (E. S. R., 47, p. 501), amplified by a brief sketch of the life of the author, a few notes by various contributors, and an extension by W. D. Bancroft to the chapter on the theory of catalysis.

Oxidation and reductions in the animal body, II D. DAKIN (*London and New York: Longmans, Green & Co., 1922, 2. ed., rev., pp. IV+176*)—The principal changes in the revision of this monograph (E. S. R., 28, p. 607) have been in the section on the carbohydrates, which has been practically rewritten.

The synthesis of glycine from formaldehyde, A. R. LING and D. R. NANJI (*Biochem. Jour., 16 (1922), No. 5, pp. 702, 703*).—The method described consists in the condensation of formaldehyde with ammonium cyanid at low temperatures in the presence of glacial acetic acid and the hydrolysis of the methylene aminoacetonitrile thus formed by boiling with a concentrated solution of barium hydroxid. The yield by this method, the technique of which is described in detail, is said to be 54 per cent of the theoretical yield.

The chemistry of foods and condiments in the years 1919, 1920, and 1921, E. BAUER (*Chem. Ztg., 46 (1922), Nos. 94, pp. 705, 706; 97, pp. 725-727; 100, pp. 750, 751; 109, pp. 813-815; 112, pp. 837-840; 120, pp. 905-907*).—This is a brief review of recent literature, chiefly from German sources, on the following topics: Food chemistry, control, and legislation; nutrition problems; general methods of investigation; meat and meat products, eggs, and edible fats and oils; flour, bread, pastry, yeast, and baking powder; legumes; general methods of preservation; vegetables and fruits and the production of alcohol-free beverages; sugar and artificial sweetening agents, natural and artificial honey; spirits and soft drinks; wine, and alcoholic beverages; and commodities.

A practical new colorimeter, E. MOREAU and A. BONIS (*Ann. Palsif., 15 (1922), No. 167-168, pp. 357-360, fig. 1*).—In the colorimeter described the tube to contain the standard liquid for comparison is connected by a side tube provided with a stopcock to a reservoir from which more or less liquid can be admitted to the tube by pressure on a rubber syringe connected with the reservoir. In this way the standard can be admitted until the colors match and the intensity of the color determined by the difference in height of the two columns of liquid, each of which is set against a scale graduated in millimeters.

Note on the use of the Mohr pipette, W. D. ILLER (*Jour. Indus. and Engin. Chem., 14 (1922), No. 10, p. 943*).—In a brief contribution from the Kentucky Experiment Station, the author suggests a simple device for use with the Mohr pipette. This consists in slipping over the end of the pipette a short length of rubber tubing in which is inserted a tightly-fitting glass bead. A slight

pressure over the glass bead with the thumb and forefinger serves to control the filling and emptying of the pipette. Various advantages in the use of this device are summarized briefly.

Adsorption by activated sugar charcoal, I, F. E. BARTELL and E. J. MILLER (*Jour. Amer. Chem. Soc.*, 44 (1922), No. 9, pp. 1866-1880).—A method for the preparation of a pure activated cane sugar carbon is described, and a comparison of the adsorbability of this and other carbons for solutions of methylene blue is reported. The results obtained are thought to indicate that the adsorption is partially if not entirely hydrolytic in nature. Up to a certain point the products of hydrolysis, namely methylene blue hydroxid and hydrochloric acid, are both adsorbed, although at different rates and beyond this point methylene blue hydroxid is adsorbed to a greater extent than hydrochloric acid, the latter remaining in solution.

The hydrogen-ion concentration.—I, Theoretical foundations, I. MICHAELIS (*Die Wassertoffionen-Konzentration.—I, Die Theoretischen Grundlagen. Berlin: Julius Springer, 1922, 2. ed., rev., vol. 1, pp. XI+262, figs. 32*).—The rapid progress in this subject since the first edition (*E. S. R.*, 32, p. 801) has necessitated the subdivision of the work into several volumes, of which this is the first. The theoretical physico-chemical foundations of the subject are treated in this volume under the main headings of the chemical equilibrium of the ions and the ions, especially hydrogen ions, as the source of electrical potential differences.

Further observations on color standards for the colorimetric determination of H-ion concentration, L. S. MEDALIA (*Jour. Bact.*, 7 (1922), No. 6, pp. 589-597).—Further directions are given for the preparation of the author's color standards previously noted (*E. S. R.*, 44, p. 411). In addition to the set of tubes required according to the original method, the author suggests the use of an acid and an alkaline tube at either end of each set of the color standards, such tubes to contain 10 cc. of the acid and the alkaline solution, respectively, as used for the particular indicator. The value of these additional tubes is considered to be in allowing a more correct measurement of an unknown when it nearly matches the tube at either end of the series.

A table is given in which are brought together all of the data needed for the preparation of the color standards and the pH values which they represent.

Volumetric determination of copper, G. JORET (*Ann. Falsif.*, 15 (1922), No. 167-168, pp. 354-356).—The method described, which is said to be applicable to the determination of copper in pure salts or mixed with salts of other metals except nickel, cobalt, and silver, depends upon the precipitation of the copper by alkaline nitroprussiate, the precipitation of the excess reagent with silver nitrate, and the titration of the excess silver nitrate with thiocyanid in the presence of iron alum.

Volumetric determination of copper and its application to the determination of reducing sugars, E. LASAUSSE (*Jour. Pharm. et Chim.*, 7, ser., 26 (1922), No. 11, pp. 401-415).—The technique described is an application of a method previously suggested for eliminating nitrites in the determination of alkaline iodids (*E. S. R.*, 42, p. 111). The cuprous oxid precipitated in the usual method of determining sugars is dissolved in a very small amount of nitric acid. The resulting solution diluted with a small volume of water is brought to boiling, and a 2 per cent solution of potassium permanganate is added drop by drop until the red color persists, alcohol being then added drop by drop to reduce the excess of permanganate. The solution is boiled for a minute longer, the precipitated manganese oxid is filtered off, and the filtrate made up to a volume of 100 cc., 25 cc. of which is used for the iodometric determination.

For the quantitative analysis of a mixture of sugars containing glucose, the author uses the technique of Quisumbing and Thomas (E. S. R., 46, p. 113) with the volumetric determination just described.

Determination of total nitrogen in cyanamid and nitrate mixtures—Davisson-Parsons method, K. D. JACOB and W. J. GELDARD (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 11, pp. 1045, 1046).—A comparison is reported from the Bureau of Chemistry, U. S. D. A., of various methods of determining total nitrogen in mixtures of calcium cyanamid and nitrates. The methods studied included the Gunning-Forster method as used by the nitrate laboratory of the Bureau of Chemistry, the Gunning method modified to include the nitrogen of nitrates as described in the Official methods (E. S. R., 44, p. 9), and the Davisson-Parsons method (E. S. R., 40, p. 711). The technique of these methods is outlined, and data are given on the results obtained with them on cyanamid alone and on aqueous mixtures of cyanamid and nitrate nitrogen.

The results obtained with the Davisson-Parsons method were much more accurate, particularly on mixtures containing considerable moisture. "Further work on this method with the view to its adoption as an official method for total nitrogen including nitrates therefore seems highly desirable."

Note on Knoop's test for histidin, G. HUNTER (*Biochem Jour.*, 16 (1922), No. 5, pp. 637-639).—Knoop's test for histidin, the brownish-red color which develops when the solution to be tested is treated with bromin water to a slight excess and heated, has been found to give different results with slight variations in the bromin excess. To obviate this the author recommends adding a definite excess of bromin, washing the solution repeatedly with chloroform until it is no longer colored, and then heating as in the usual test. It is stated that by this procedure even strongly colored meat extracts can be tested successfully and in a much greater dilution than with the original test. The proportion of 3 atoms of bromin to each molecule of histidin is said to give the maximum color on heating.

Radioactivity of miscellaneous waters examined in the Bureau of Chemistry, W. W. SKINNER and J. W. SALE (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 10, pp. 949, 950).—Determinations are reported from the Bureau of Chemistry, U. S. D. A., of the radioactivity of various natural waters collected at their source by a bureau representative, and of several samples of domestic and imported bottled waters reported to possess radioactivity.

"The significance of the data depends on the fact that we have never found in any commercial bottled water of natural origin sufficient radioactivity, either temporary or permanent, to warrant its purchase by consumers because of its content of radioactivity."

Examination of authentic grape juices for methyl anthranilate, F. B. POWER and V. K. CHESNUT (*Jour. Agr. Research* [U. S.], 23 (1923), No. 1, pp. 47-53).—This communication from the Bureau of Chemistry, U. S. D. A., consists of the report of a further study of the occurrence of methyl anthranilate in authentic samples of grape juice prepared from definite varieties of the fruit in different sections of the country (E. S. R., 46, p. 207).

The test, conducted as previously described (E. S. R., 45, p. 207), gave positive results with all but a few of the varieties grown in the Eastern States and negative results with grapes of the Southern States and with California grapes. Classified as to species, all grapes regarded by viticulturists as representing purebred *Vitis labrusca* and with few exceptions the varieties representing hybrids of *V. labrusca* contained methyl anthranilate, while varieties of *V. vinifera* (California grapes) and of *V. rotundifolia* (southern grapes) do not contain it.

Of the tests for methyl anthranilate which have been conducted on commercial grape juices only a few gave negative results. These included two clear pale yellow samples designated simply as grape juice, one designated as Catawba juice, three of red California juices, and one red juice obtained from the State of Washington. These results conform to the tests of pure authentic juices, but among the samples giving positive tests was a California product labeled Concord grape juice, which in color and odor was quite unlike a pure Concord juice, and which was consequently considered to be of doubtful authenticity and purity.

It is suggested in conclusion that the methyl anthranilate test may be of possible use in determining the botanical origin of grapes in cases of uncertainty.

Studies on rancidity.—I, The influence of air, light, and metals on the development of rancidity, J. A. EMERY and R. R. HENLEY (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 10, pp. 937-940).—In this contribution from the Bureau of Animal Industry, U. S. D. A., the results are reported of a series of tests in which lard, and, in later tests, cottonseed and corn oil were stored under various conditions and then tested for rancidity by the Kreis test.

It was found that fats could be kept in contact with metals such as lead, copper, and tin and exposed to light and summer temperature without developing rancidity, provided that air was excluded by mechanical means. The development of rancidity was not prevented, however, by passing CO_2 continuously through the receptacle containing the fat. With free access of air rancidity developed in fats more rapidly and to a greater extent when the fats were exposed to metals, while some metals hastened the chemical changes producing rancidity to a greater extent than others. The action of the metal did not appear to be connected with the corrosive action of the fat upon the metal.

Fats in contact with metals and not exposed to light developed rancidity, while for the development of rancidity in fats exposed to air but not in contact with metals, light appeared to be necessary. Lard was more readily affected by these conditions than was cottonseed oil or corn oil. Of the two vegetable oils, corn oil proved the more stable. To prevent the effect of metal in promoting rapid production of rancidity, the author suggests that metal containers be given an unbroken coating of lacquer.

The use of iodine in the determination of glucose, fructose, sucrose, and maltose. F. A. CAJORI (*Jour. Biol. Chem.*, 54 (1922), No. 3, pp. 617-627).—As the result of an investigation of the conditions under which sugar is oxidized by iodine, a method has been developed for the determination of glucose alone and mixed with fructose and sucrose, with the possible inclusion of maltose. With a pure glucose solution the concentrations of reagents and conditions most favorable for the reaction were found to be as follows:

"To 10 cc. of a glucose solution, containing 34.56 mg. of glucose, 2 cc. of a 15 per cent Na_2CO_3 solution were added; 15 cc. of an $\text{N}/10$ iodine solution were then added, and the flask was stoppered and placed in the dark at room temperature for 25 minutes. Slightly more 10 per cent H_2SO_4 than that needed to neutralize the Na_2CO_3 was added, and the iodine titrated immediately with $\text{N}/20 \text{ Na}_2\text{S}_2\text{O}_4$."

For the analysis of glucose-fructose-sucrose solutions, use is made of the fact that iodine oxidizes glucose but not fructose or sucrose, while cupric hydroxide oxidizes both glucose and fructose. Oxidation with iodine is first carried out as described above, following which oxidation with Benedict's copper reagent is carried out by the Spoehr technique, which consists in placing centrifuge tubes containing the sugar and copper reagent in a boiling water

bath for 3 minutes, removing the cuprous oxid by centrifuging, and determining the residual cupric copper by titrating the iodine liberated from an excess of potassium iodide by the cupric copper with sodium thiosulphate.

The sucrose is estimated by hydrolyzing the solution for 2 hours at 60° C. with 1 per cent hydrochloric acid, and determining its reducing power with either iodine or cupric hydroxid. It is thought possible also to extend the method to maltose by hydrolyzing the maltose with yeast maltase solution.

The determination of the pH value of commercial glucose as a substitute for the candy test, O. A. SJOSTROM (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 10, pp. 941-943, fig. 1).—The author has applied the colorimetric H-ion concentration test to the judging of glucose in place of the so-called candy test. For standard solutions the Sørensen citrate mixtures are used, and for the indicator a 0.02 per cent alcoholic solution of methyl red. Ten-cc. samples of the glucose diluted to 22° B. and of the standards are used for comparison, the determination being made in daylight in a comparator of the Walpole type. It has been found possible to determine the pH values to 0.1 pH in the upper, more acid part of the series, and 0.05 pH in the lower part.

A comparison of the inversion figures from the candy test and the pH values of a number of samples of glucose shows a considerable variation in the former for samples of the same pH value, thus indicating that the latter determination is more reliable for judging the real acidity of the glucose. The pH values corresponding to the limit of invert sugar adopted from the candy test lie between 4.1 and 4.2. In practice 4.3 or higher pH values are passed, while if the sample has a pH value below 4.3 it is subjected to the candy test.

The precipitate formed in sugarhouse sirups, J. F. BREWSTER and W. G. RAINES, JR. (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 10, pp. 946, 947).—Data are contributed from the Louisiana Sugar Experiment Station on the nature and extent of the precipitate formed on standing in sugar cane sirup subjected to different methods of clarification. From a comparison of these figures with the method of treatment employed and the appearance of the sirup after clarification, the authors conclude that the amount of precipitate can not be predicted from the appearance of the filtered juice or sirup, some apparently clear sirups giving a greater precipitate than other turbid sirups. The formation of the precipitate may be attributed to three possible sources, the materials used in clarification, substances in the cane juice itself, and the soil adhering to the cane at the time of crushing.

The most feasible method of handling such sirup is thought to be the addition to the sirup of some absorbent heavy enough to subside quickly and carry the suspended matter with it. Fuller's earth, precipitated chalk, and calcium phosphate are thought to be suitable for this purpose.

Sugar formation in a sulphite digester, E. C. SHEERARD and C. F. SUHM (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 10, pp. 931, 932, figs. 3).—An investigation under controlled conditions of the sugar formation during the digestion of white spruce pulp is reported, the results of which indicate that the rate of sugar formation depends upon the temperature, the concentration of free sulphur dioxide, and the time of digestion. But little sugar forms before a temperature of about 108° C.

The chemistry of wood.—IV, The analysis of the wood of Eucalyptus globulus and Pinus monticola, S. A. MAHOOD and D. E. CABLE (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 10, pp. 933, 934).—Continuing the series of studies by Schorger previously noted (*E. S. R.*, 37, p. 710), the analyses are reported of the wood of two new species, western white pine (*P. monticola*) and eucalyptus (*E. globulus*). The results of the analyses of four representa-

tive samples of each series are similar to those reported by Schorger for conifers and broad-leaved trees, respectively. The essential differences are that the western white pine is less soluble in hot and cold water and in alkali than the long-leaved pine. The eucalyptus is distinguished from other hard woods already studied in this series by its low ash content and smaller yield of acetic acid. The cellulose isolated from the two woods contains approximately the same amount of alpha-cellulose, while the remaining portion in the case of eucalyptus is almost entirely gamma-cellulose, and in the case of pine equally divided between beta- and gamma-cellulose. The lignin values are higher for pine than for eucalyptus.

Chemistry of wood.—V. Results of analysis of some American woods, G. J. RITTER and L. C. FLECK (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 11, pp. 1050–1054).—Continuing the above investigation, analyses by the same methods are reported of eight woods varying in density from hickory with a very high density to balsa of extremely low density. The species are as follows: Western yellow pine (*Pinus ponderosa*), yellow cedar (*Chamaecyparis nootkatensis*), incense cedar (*Libocedrus decurrens*), tanbark oak (*Quercus densiflora*), redwood (heartwood) (*Sequoia sempervirens*), mesquite (*Prosopis juliflora*), balsa (*Ochroma lagopus*), and shellbark hickory (*Hicoria ovata*). A comparison of results may be summarized as follows:

In general the hardwoods differ from the soft in a higher percentage of ash, lower content of ether-soluble material, slightly higher methoxy content, higher percentage of pentosan, and lower percentage of methyl pentosan. No appreciable difference was found in the cellulose content, but a difference was noted in the nature of the cellulose in that the hardwood cellulose retains a higher percentage of furfural-yielding bodies and a low content of beta-cellulose. There was no great distinction between hard and soft woods in the content of lignin.

Distribution of methoxyl in the products of wood distillation, L. F. HAWLEY and S. S. AIYAR (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 11, pp. 1055–1057).—This paper reports the results of an attempt at the Forest Products Laboratory, Madison, Wis., to trace the discrepancy between the yield of methyl alcohol in the distillation of maple, oak, and incense cedar and the amount of methoxyl groups known to be present in these woods. The general plan consisted in determining the methoxyl in a sample of wood and then distilling the wood, with or without previous chemical treatment, and determining the methoxyl in the various crude products, settled tar, dissolved tar, tar-free pyroligneous acid, charcoal, and gas. A part of the loss was traced to methane obtained during the distillation, and a part to methoxyl groups found in the charcoal and in the tar. Soft woods give more methoxyl in the settled tar and more methane in the gas than hard woods.

Ethyl alcohol from western larch (*Larix occidentalis*), E. C. SHERRARD (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 10, pp. 948, 949).—Experimental work is reported from the Forest Products Laboratory, Madison, Wis., on the production of alcohol from the western larch, which contains a large amount of galactan soluble in water. Two methods were employed. In one, the galactan was extracted from the wood with hot water and then hydrolyzed by boiling for four hours in a sufficient quantity of sulphuric acid to make a 4 per cent solution. The galactose solution thus formed was neutralized with calcium hydroxide and evaporated under reduced pressure until a solution was obtained which contained about 5 per cent total reducing sugar. The residue remaining after the water extraction was digested in an autoclave for 15 minutes at 115 lbs. pressure with a quantity of sulphuric acid corresponding to from

1.5 to 2.5 per cent of the dry weight of the wood. The resulting sugars were then extracted with water, neutralized with calcium hydroxid, and evaporated as in the case of the galactose solution.

In the other method the unleached larch was hydrolyzed under the same conditions as described for the residue after water extraction, and the sugars were extracted and prepared for fermentation in the same way. In each case the sugar solutions were prepared for fermentation by adding a sufficient quantity of 10 per cent solution of autolyzed yeast to make the whole correspond to a 2 per cent yeast solution, boiling, filtering, and sterilizing in an Arnold steam sterilizer, and then fermenting with a pure strain culture of a Hungarian beer yeast.

In all cases the fermentation took place better in the galactose solution than in the liquor containing the mixed sugars. The average yield in the first method was 39.9 gal., and in the second 33 gal. of 95 per cent ethyl alcohol per ton of dry wood.

Maize as a raw material for manufacture, J. BURT-DAVY (*So. African Jour. Indus.*, 5 (1922), Nos. 1, pp. 26-33, figs. 4; 2, pp. 80-85; 3, pp. 130-136; 4, pp. 177-183; 5, pp. 217-222; 6, pp. 245-254; 7, pp. 324-329; 8, pp. 357-364; 9, pp. 407-413, figs. 3; 10, pp. 473-479).—This is an extensive compilation of information on the various uses which can be made of the maize or corn plant. Following a list of the articles that may be obtained from the various parts of the plant, a brief outline is given of the composition of the grain and the manufacture from it of starch, glucose, and various by-products. This is followed by sections on the utilization of maize flowers, stalks, and leaves; the fermentation products from maize husks, cobs, and chaff; and the food value, handling, and storage of maize grains.

METEOROLOGY.

Meteorological observations [at the University of Maine, Orono], J. S. STEVENS (*Maine Sta. Bul.* 304 (1921), pp. 359-361).—A tabular summary is given of monthly and annual temperature, precipitation, cloudiness, and wind during 1921. The mean temperature for the year was 42.94° F., as compared with 43.11° for 53 years; the precipitation was 25.98 in., as compared with a 53-year mean of 39.42 in. The snowfall was 44.25 in., the number of clear days, 141.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. OSTRANDER and G. E. LINDSKOG (*Massachusetts Sta. Met. Buls.* 407-408 (1922), pp. 4 each).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during November and December, 1922, are presented. The general character of the weather for November is briefly discussed, and the December bulletin gives a summary for the year. The principal data in this summary are as follows:

Mean pressure 30.058 in.; mean (hourly) temperature 47.2° F., maximum 94° July 12, minimum -13.5° February 18; total precipitation 45.94 in., snowfall 58.75 in.; cloudiness 1,932 hours; bright sunshine 2,522 hours; prevailing direction of wind, west, total movement 49,970 miles, maximum daily 467 miles December 6; last frost in spring May 12, first in fall September 19; last snow April 23, first November 24.

Average annual precipitation (U. S. Dept. Agr., Weather, Crops, and Markets, 3 (1923), No. 2, p. 31).—The average annual precipitation at various Weather Bureau stations throughout the country is given and briefly discussed.

It is stated that "on the basis of precipitation, the United States may be divided into an eastern and a western half, the dividing line being approximately the hundredth meridian, in the vicinity of which the average annual amount is about 20 in. In general, precipitation is sufficient east of this meridian for successful farming by ordinary methods, but to the westward it is insufficient over large areas for the requirements of crop growth, and irrigation, or special cultural methods for conserving soil moisture, is often employed.

"East of the Mississippi Valley the amount of precipitation varies from about 30 in. in the western upper Lake region to 55 or 60 in. along the Gulf coast. In the Great Plains States it varies from about 20 in. in the eastern portions of the Dakotas and 25 in. in central Kansas and western Oklahoma to less than 15 in. in much of Montana and some localities in the west-central and southwestern Plains region. In the Pacific Coast States great differences in precipitation obtain, the average annual amounts ranging from 120 in. in some mountainous districts in western Washington to less than 5 in. in the extreme southeastern portion of California. These localities represent the extremes of moisture conditions found in the United States.

"There are a number of distinct types of seasonal distribution of precipitation, the most important of which are the Pacific, Plains, and Eastern. The Pacific type is found in the Pacific Coast States and is characterized by a marked winter concentration of precipitation and a summer dryness. In the central and southern portions of the Pacific coast region less than 20 per cent of the annual rainfall occurs during the six warm months of the year, and in some localities only about 10 per cent occurs during that period. In the Great Plains region, on the other hand, much the greater portion of the annual precipitation is received during the crop-growing season, the percentages ranging from 70 per cent to more than 80 per cent for the period between April 1 and September 30. In portions of Montana and over small areas of the Dakotas and eastern Colorado the average precipitation for the three winter months is less than 1 in.

"The Eastern type, broadly speaking, includes the country from the Mississippi Valley eastward and is characterized by a comparatively uniform distribution of precipitation throughout the year. However, rainfall during the autumn months is usually lighter than during any other season, particularly in most of the cotton belt, a condition favorable for gathering the cotton crop."

Precipitation during 1922 (*U. S. Dept. Agr., Weather, Crops, and Markets*, 3 (1923), No. 4, p. 79).—A table is given which shows "the total precipitation and the percentages of normal for the year 1922 at various [175] Weather Bureau stations throughout the country." The figures "indicate that rainfall for that period was very unevenly distributed geographically. . . . From the Mississippi Valley eastward, the amounts ranged generally from about 30 in. in the upper Lake region to between 50 and 60 in. in most of the Gulf Coast States, although slightly less than 30 in. of precipitation fell in much of Pennsylvania. Between the Mississippi River and the Rocky Mountains, the amounts varied from slightly more than 12 in. at Havre, Mont., to about 50 in. in southeastern Texas. Less than 10 in. were reported in most of the southern Rocky Mountain districts and the far Southwest. On the Pacific coast precipitation varied from about 60 in. in extreme northwestern Washington to a little more than 9 in. in extreme southern California.

"The outstanding features of precipitation during the year compared with the normal were the large deficiencies in amount in the far Northwest, especially in western Washington, and also in the area from central Colorado

southward. Tacoma, Wash., received but little more than half the normal annual rainfall, while in extreme western Texas and southeastern New Mexico less than half the annual amount was received. There was a general deficiency also in the Central-Northern States from the western upper Lake region westward to the Rocky Mountains, except at a few points in Montana and North Dakota. Less than the normal amount was recorded very generally from western Tennessee, Arkansas, and Missouri northeastward over the Ohio Valley and Lake region. The year was unprecedentedly dry in portions of Pennsylvania, Philadelphia reporting the least annual precipitation in 100 years. Compared with the normal, the amounts were unevenly distributed in New York and New England, some stations receiving more and others less than normal. In the Atlantic Coast States from Virginia southward and also in the Gulf States more than the normal amount of precipitation fell as a rule, although a few stations show deficiencies. There was more than the normal amount also in north-central Texas, southeastern Kansas, central and western South Dakota, extreme northwestern North Dakota, southeastern Montana, the northern portions of Utah and Nevada, and in much of the central portion of California."

[**Rainfall in Arizona**], J. J. THORNER (*Arizona Sta. Rpt. 1921*, pp. 576, 577).—The amount, distribution, and injurious effects of the scanty rainfall during the year ended June 30, 1921, are briefly discussed. The rainfall for that year was so light, being only 6.32 in. at Tucson, that the ranges were injuriously affected and heavy losses of stock occurred.

It is stated that Arizona does not have what may in the proper sense be called a "normal" rainfall. "The rainfall for one year can not be taken as any indication of what may be expected the next year. Years of average rainfall may be followed by dry years or wet years." The rainfall at Tucson for the year ended June 30, 1920, was 20.54 in., or more than three times the amount for the succeeding year. The former was the heaviest annual rainfall recorded for 39 years, the latter the lightest in 17 years. Other dry years, with the usual heavy losses of stock from starvation, were as follows: 1894-95, with a rainfall at Tucson of 5.65 in.; 1899-1900, with 7.42 in.; 1901-2, 6.99 in.; and 1903-4, 6.26 in.

SOILS—FERTILIZERS.

Soil survey of Oconee, Morgan, Greene, and Putnam Counties, Ga., D. D. LONG ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919*, pp. 61, fig. 1, maps 2).—This survey, made in cooperation with the Georgia State College of Agriculture, deals with the soils of an area of 830,720 acres comprising four counties lying wholly within the Piedmont Plateau in north-central Georgia. The topography is rolling to hilly. Drainage is said to be very complete.

The soils are derived from crystalline rocks of varying composition. Including meadow and rock outcrop, 24 soil types of 12 series are mapped, of which the Cecil sandy clay loam and sandy loam and the Davidson clay loam cover 41.2, 15.9, and 12.3 per cent of the area, respectively.

Soil survey of Carroll County, Md., R. T. A. BURKE (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919*, pp. 37, fig. 1, map 1).—This survey, made in cooperation with the Maryland Experiment Station and Maryland Geological Survey, deals with the soils of an area of 286,080 acres lying in the Piedmont Plateau in northern Maryland. The topography ranges from level to gently rolling in the northwestern part to hilly and rolling in the eastern and southeastern parts. In general, the county is said to have excellent natural drainage.

Most of the soils are of residual origin. Thirteen soil types of 8 series are mapped, of which the Manor and Chester loams and the Penn silt loam cover 19.5, 17.6, and 15 per cent of the area, respectively.

Soil survey of Sioux County, Nebr., W. A. ROCKIE ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. IV+43, fig. 1, map 2*).—This survey, made in cooperation with the University of Nebraska, deals with the soils of an area of 1,814,200 acres lying in the High Plains division of the Great Plains region in northwestern Nebraska. The topography is generally rolling, but ranges from nearly flat in the valley lands to rugged in the Pine Ridge escarpment. Drainage is said to be generally ample.

The soils are mostly of residual origin but include also alluvial, colluvial, and wind-formed soils. Including rough broken land, dunesand, badlands, and marsh, 27 soil types of 11 series are mapped, of which the Rosebud very fine sandy loam and loamy fine sand cover 33.1 and 17.7 per cent of the area, respectively.

Agronomic and agrologic survey of the Sétif region, I. POUGET, AMALRIC, and LÉONARDON (*Esquisse Agronomique et Agrologique de la Région de Sétif. Algiers: Univ. Alger Lab. Chim. Appl. Facult. Sci., 1922, pp. 73, pls. 4*).—This report deals with the topography, rainfall, geology, and soils of the country immediately surrounding the town of Sétif in the uplands of Algeria. The topography of this area varies from mountainous to that of a vast plain with a gentle slope. The rainfall apparently is limited, and the climate is essentially arid.

Mechanical, physical, and chemical analyses of the prevailing soil types are presented and discussed. The best agricultural soils are the black marl soils of the northern and central parts of the area and the alluvial soils. These soils are deep and contain a large percentage of fine materials, which permit the retention of a sufficient reserve of moisture. The red calcareous silts are of lesser depth and have a lower moisture retaining capacity, and in the more arid regions the crop yields are sparse.

The soils of the area are said to be generally well supplied with plant nutrients. The nitrogen content is rarely lower than 1 per cent, and soils deficient in phosphoric acid are very rare. The soils are also well supplied with potassium and magnesium. It has been found, however, that these great reserves of nitrogen and phosphoric acid are frequently in more or less unavailable form, so that returns have been realized from nitrogenous and phosphatic fertilization of a more available nature. The apparent limiting factor in soil fertility in the area is moisture. It has been found that this can be materially improved by developing the organic matter content of the soils.

A study of brak soils in the Transvaal, F. J. TROMP and J. B. OSBORN (*So. African Jour. Indus., 5 (1922), No. 5, pp. 206-214, figs. 4*).—Alkali soils in general are discussed and methods of their treatment are described. Special attention is drawn to the alkali and barren soils adjacent to the Pienaars River in South Africa, and analyses of representative samples are presented and discussed.

These soils are of a loose, porous nature, and it has been found that a very large amount of water gains access to them by seepage from furrows and dams. The water table is very low, and the salts are very rapidly carried to the surface by the evaporation of the surface water and the rise of more water from below to take its place.

Percolation experiments with these soils show that when untreated, water penetrated only 1.5 in. in 24 hours. Treatment with gypsum and stable manure very markedly improved their permeability. Pot and plat experiments

with mealies agreed in showing that these soils, without treatment, were more or less unproductive. The lack of productiveness is attributed largely to poor physical condition produced by the influence of alkali.

The soils of the Murrumbidgee irrigation areas, H. J. BRAUND (*Agr. Gaz. N. S. Wales*, 33 (1922), No. 9, pp. 631-638).—The soils of the Murrumbidgee irrigation areas are discussed with particular reference to the development of their capacity for fruit production under irrigation. Subsoiling especially has been found to substantially increase both the vigor of the root system and the yield of lucern crops. While subsoiling is distinctly beneficial to plant growth in these soils, it has been found that this operation fails to convert the soil colloids into a crystalloidal state, so that the inherent sticky nature persists to the detriment of maximum yields.

A microscopic method for demonstrating fungi and Actinomycetes in soil, H. J. CONN (*Soil Sci.*, 14 (1922), No. 2, pp. 149-151).—In a contribution from the New York State Experiment Station a microscopic method for demonstrating the abundance of vegetative forms of fungi and Actinomycetes in soil is described. In the improved technique of this method a small crumb of soil of 10 mg. or less is placed upon a microscopic slide and mixed with two or three drops of water. A small glass rod dipped into a methylene blue solution is introduced into the drop of soil infusion on the slide, which is mixed together well and covered with a cover slip, removing any sand grains that prevent the cover slip from resting level. If too much stain has been added, it may be washed out without removing the cover glass by placing a drop of water on one side and touching the other side with a piece of filter paper. A dry lens and a high-power eyepiece are used for examination. The combination of lenses that proved best for general purposes was a 16 mm. objective with a 15x compensating eyepiece.

By using this technique, fungus filaments or at least fragments thereof were observed in nearly all of the soils examined. In the greater number of cases, however, the filaments were far from abundant. These observations are taken to indicate that plate counts of spore-forming organisms give no real idea as to their activity in any substance under investigation. By using the microscopic technique described, it is possible, for instance, to demonstrate an increase in the number of Actinomycetes in soil in which young grass is growing.

Modern work on soil physics, G. G. AUCHINCLOSS (*Trop. Agr. [Ceylon]*, 59 (1922), No. 3, pp. 174-184).—This is a summary of the results obtained by others on different phases of soil physics, including studies of surface area of particles of soil, soil water, film water, moisture equivalent, hygroscopic moisture, soil air spaces, moisture movement, soil water and the plant, transpiration ratios, capillary rise, behavior of very small particles, colloidal clay, soil shrinkage, colloidal soil jelly, absorption of dissolved minerals, and lime requirements.

The absorption of water by soil colloids, W. O. ROBINSON (*Jour. Phys. Chem.*, 26 (1922), No. 7, pp. 647-653).—Studies conducted by the U. S. Department of Agriculture are reported in which it was found that samples of the colloidal matter extracted from 34 soils which differed widely in texture, origin, mode of formation, and chemical composition showed a relatively constant absorption of water. The extreme absorptions were 0.24 and 0.348 gm. of water per gram of colloid, and the mean value was 0.298. It is suggested that the colloidal matter in the soil might be fairly closely estimated by determining under certain conditions the water absorption of the soil and dividing the result by the average factor 0.298.

Swelling coefficients of dry soils when wetted, A. E. VINSON and C. N. CATLIN (*Arizona Sta. Rpt.* 1921, p. 557).—Tabular data correlating the so-called

swelling coefficient of a few dry soils of widely varying texture when wetted with the mechanical analysis and moisture equivalent are briefly presented.

Field moisture capacity and wilting point of soils, W. L. POWERS (*Soil Sci.*, 14 (1922), No. 2, pp. 159-165, fig. 1).—Studies conducted at the Oregon Experiment Station are reported, which showed that the wilting point or drought point of soils is a valuable indicator in connection with the determination of the exact moisture content at which to irrigate, the purpose being to maintain a favorable soil moisture content. The wilting point was found to vary more between different crops than has commonly been supposed when judged by field and tank studies of crop appearance, soil moisture, and yield of dry matter. The wilting point appeared to vary more for different crops on a soil which is rather heavy in texture than on a soil of narrow moisture limits. It also marked the lower limit of usable water.

The usable field-moisture capacity as judged by samples taken before and after irrigation, cylinder tests of field-moisture capacity, the physical composition, and the determination of other moisture points showed that only the heavier classes of normal soils are capable of retaining as much as 2 in. of usable water in the surface acre-foot. The coarsest soils used for irrigation retained only 0.5 in. per foot of depth, while peat retained from 3 to 4 in. of usable water per acre-foot.

The irrigation requirement was greater for soils of coarse texture and low humus content, and is considered to be largely due to unavoidable waste in connection with light, frequent irrigation.

The vertical movement of "alkali" under irrigation in heavy clay soils, F. T. SHUTT and A. H. BURWASH (*Roy. Soc. Canada, Proc. and Trans.*, 3, ser., 15 (1921), Sect. III, pp. 61-64).—Studies of the vertical movement of alkali under irrigation in heavy, stiff, almost impervious clay loam overlying a subsoil of an extremely heavy and impervious character, carrying a notable saline content, are reported.

It was found that irrigation under the conditions of the experiment did not cause any appreciable rise of alkali during the 5-year period. It is considered probable that an area of heavy clay may be safely irrigated for a number of years, notwithstanding the presence of a close, almost impervious subsoil strongly impregnated with alkali, provided that at the outset the surface soil is free from alkali and surplus water is removed by surface drains and ditches.

Influence of concomitant conditions on the toxicity of black alkali, A. E. VINSON and C. N. CATLIN (*Arizona Sta. Rpt.* 1921, pp. 558, 559).—Progress results of these studies are briefly noted. With concentrations of sodium carbonate as low as from 0.05 to 0.075 per cent sorghums made very weak growth. With winter cultures wheat proved much more resistant to black alkali than barley. Sand mixed with alkali soil greatly intensified the toxicity of the black alkali, while clay had a neutralizing effect.

The sulphur-oxidizing power of soils, A. DEMOLON (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 25, pp. 1408-1410).—Studies on the mechanism of the oxidation of elementary sulphur in soils are reported. A culture medium was used consisting of washed sand to which were added a suitable nutrient solution, elementary sulphur, and sometimes precipitated calcium carbonate. This was inoculated with solutions from various soils, all of which apparently contained organisms capable of oxidizing sulphur.

The oxidizing power of the different soils varied rather widely. After 30 days' incubation this varied from about 13 to 75 mg. of sulphur per 100 gm. of medium. The light soils well supplied with organic matter showed the most oxidation.

In the presence of about 0.2 per cent urea the addition of calcium carbonate accelerated sulphur oxidation. In the presence of 1 per cent of urea the addition of calcium carbonate had no influence as the decomposition of the urea maintained neutrality in the medium.

The oxidation of sulphur in soil was found to be due to ammonifying bacteria. The more active oxidizing organisms isolated in pure culture were a form of *B. fluorescens liquefaciens*, *B. mycoides*, and an unnamed organism. When the culture medium was inoculated with pure cultures of these organisms, the sulphur oxidized was 85, 70, and 69 mg. per 100 gm. of medium, respectively. Several other organisms were isolated which showed lesser sulphur-oxidizing powers. Human fecal flora and *Proteus* of intestinal origin gave negative results.

Occurrence of sulphids in Minnesota peat soils, C. O. ROST (*Soil Sci.*, 14 (1922), No. 2, pp. 167-174).—Studies conducted at the Minnesota Experiment Station are reported which showed that in samples of peat and muck from the Golden Valley Peat Experimental Fields in northwestern Minnesota in 1918, sulphids were generally found at all levels in the peat, in the muck substratum, and in the upper portion of the mineral subsoil below. The greatest amount was found in the lowest portion of the peat layer and not in the muck. The reactions of the peat and muck were but little related to the relative amounts of sulphids present, but more closely to conditions permitting the oxidation of the sulphid to sulphuric acid and ferrous sulphate.

The layers in an exposed ditch face strongly impregnated with sulphid gave a more acid reaction than did those at some distance from the ditch. A year later after an unusual flood had widened the ditch and exposed fresh material, the peat of the ditch face was found to be similar in reaction to the corresponding layers farther back. Expressing the sulphid content as hydrogen sulphid, 19 samples of peat and muck showed a maximum of 0.06 and a minimum of 0.016 per cent for the lowest layer of peat and 0.013 and 0.002 per cent, respectively, for the muck substratum immediately below. Sulphids appeared to be much more commonly associated with peat in northwestern than in northeastern Minnesota, where in an area of approximately 75 square miles sulphids were found at only one place.

Notes on the nature of burn-outs, F. T. SHUTT and A. H. BURWASH (*Roy Soc. Canada, Proc. and Trans.*, 3, ser., 15 (1921), Sect. III, pp. 65-68, fig. 1).—Studies into the origin and nature of irregular but roughly circular depressions or eroded spots, varying from 3 to 6 in depth and from a few inches to several feet in diameter and occurring on the surface of prairie soils in western Canada, are reported.

The evidence is considered to indicate that the so-called burn-outs represent areas from which the surface soil has been removed. The soil of a burn-out for the first few inches is extremely hard, and so impervious that after water has been standing on the spot for several days, the soil beneath the first few inches is still hard and dry. After breaking for cultivation this burn-out soil apparently becomes as pervious as the soil or subsoil of the adjacent area. When these burn-outs are large, it is noted that for a few years after breaking the crops upon them are lighter than those on the surrounding unaffected soil. This disparity tends to disappear with a few years' tillage, which is in accordance with the observation that the subsoils of semiarid areas are rich in available plant nutrients and are more or less readily brought into a condition of economic productiveness as compared with those of humid districts.

Apparent infertility of the soil around trees, C. O. WILLIAMS (*Union So. Africa Dept. Agr. Jour.*, 5 (1922), No. 3, pp. 254-258).—Studies conducted at

the Cedara School of Agriculture in Natal to determine the cause of a zone of infertility frequently observed on each side of shelter belts of trees are reported.

A series of analyses of soil samples taken in the immediate vicinity of four different belts of wattle trees and at a distance of from 20 to 30 yds. away from the same belts did not give any distinct evidence that the roots of the trees had appreciably deprived the soil near them of plant nutrients. No evidence was obtained that the soil solution near the trees contained an excess of mineral salts due to the utilization of the soil water.

Studies of the moisture absorption by the trees at distances varying from 1 to 50 yds. showed that there was approximately 50 per cent more capillary moisture in the soil away from the trees than under them, although the shade and shelter of the trees would naturally tend to conserve the moisture in the soil there.

A repetition of this experiment in the same neighborhood after a heavy storm showed that there was a continuous increase in the moisture content of the soil up to a maximum distance of 20 yds. from the trees, although the increase in the last 10 yds. was very small. The amount of capillary moisture in the surface soil at 20 yds. from the trees was as much as 80 per cent more than that in the surface soil under the trees, but the increase in the subsoil was practically the same as in the first experiment.

The conclusion is drawn that the difference in productivity of the soils immediately under the trees and some distance away is due chiefly to the difference in the moisture content of the soil.

Reclamation and management of lowland moors. W. FRECKMANN (*Die Erschliessung und Bewirtschaftung des Niederungsmoores*, Berlin: Paul Parey, 1921, pp. [3]+153).—This book represents a practical summary of the important results of studies conducted by the Neuhammerstein Moor Experiment Station on the reclamation and management of lowland moor soils in eastern Germany. It contains a general description of the organization of the experiment station and of the environmental conditions of the moors studied. Other sections are included on the drainage cultivation, seeding, fertilization, and management of pasture, meadow, and general agricultural soils in these moors.

Synopsis of information concerning the peat situation in Canada. A. ANREP (*Canada Geol. Survey, Summary Rpt., 1921, pt. D, pp. 12D-16D*).—This report summarizes information on the general uses of peat, the manufacture of peat fuel in Canada, and fallacies regarding the drying of peat. Data on the area of peat lands investigated in Canada are also included. It is stated that a total of 105 bogs have been fully surveyed, with an aggregate area of approximately 224,131 acres, and containing 190,330,170 tons of fuel and 20,588,110 tons of litter containing 20 per cent of moisture.

Investigation of peat bogs in Ontario. A. ANREP (*Canada Geol. Survey, Summary Rpt., 1921, pt. D, pp. 7D-11D, pls. 3*).—Information on the area, depth, and qualities of peat contained in four peat bogs in Ontario is presented in this report.

Influence of acid and alkaline fertilization on the growth of crops (six years' practice on the experimental field at Spitzbergen). J. HUDIG and C. MEIJER (*Dept. Landb., Nijv. en Handel [Netherlands], Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefsta., No. 26 (1922), pp. 60-88, pl. 1, figs. 4*).—Studies begun in 1914 with different crops are reported, from which the conclusion is drawn that acid soils must not receive acid fertilization. Papilionaceous flowering plants were found to grow either not at all or only incompletely on acid soils, as they required a neutral or weakly alkaline soil. A

weakly acid soil was found to be desirable for potatoes. It is considered advisable to determine the reaction and lime requirement of a soil in the laboratory. Of the lime carriers, very fine marl was found to give the best results.

Continuous fertilization with stable manure for a long period was found to increase soil acidity. Fertilizer salts also had a tendency to increase the acidity of sand soils containing humus. It is considered advisable to use high percentage potash salts rather than the lower grade salts and slag in place of acid phosphate on acid soils.

The specific weight and nitrogen content of liquid manure, G. H. G. LAGERS (*Dept. Landb., Nijv. en Handel [Netherlands], Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefsta.* No. 26 (1922), pp. 9-18).—Specific weight determinations and determinations of the nitrogen content by the Kjeldahl method of a number of samples of liquid manure are reported. These showed that the Vogel aerometer method for determining the specific weight of liquid manure and the nitrogen content therefrom is not tenable. With cow urine, for which the method is said to be specially adapted, the nitrogen content was found to be usually lower than that computed from the specific weight.

Penguin guano from the Falkland Islands (*Bul. Imp. Inst. [London]*, 19 (1921), No. 4, pp. 463-465).—Analyses of samples of penguin guano from Kidney Island of the Falkland group are presented and discussed. The results are taken to indicate that these guanos are very inferior to good Peruvian guano with reference to their nitrogen and phosphoric acid contents. The water percolating through the guano deposit was found to contain soluble phosphates, and it is thought that the inferior quality of the guano may be due to prolonged leaching by rain water.

Nitrogen, L. HACKSPILL (*L'Azote. Paris: Masson & Co.*, 1922, pp. XII+271, figs. 39).—This book, a number of the Encyclopédie Léauté, second series, deals with the fixation of atmospheric nitrogen and its industrial use. It contains chapters on nitrids; nitrogen fixation in the form of cyanid, hydrocyanic acid, and cyanogen; the manufacture of calcium cyanamid; synthesis of ammonia; the Oppau and Merseburg processes; tests of ammonia synthesis made during the war in France, the United States, Italy, England, and Switzerland; ammoniacal salts and urea; synthesis of the oxids of nitrogen and their action on water; the industrial manufacture of nitric acid from atmospheric nitrogen by Norwegian, Italian, and French processes; manufacture of nitric acid by the oxidation of ammonia, comparative economic study of the different nitrogen fixation processes; methods for using mineral nitrogenous fertilizers and comparison of their fertilizing value; and production and consumption of nitrogen compounds in different countries.

Nitrate deposits in the Amargosa region, southeastern California, L. F. NOBLE, G. R. MANSFIELD, ET AL. (*U. S. Geol. Survey Bul.* 724 (1922), pp. VII+99, pls. 35, figs. 7).—This report deals with the occurrence, distribution, general character, and value of the nitrate deposits in the Amargosa region of southeastern California.

The nitrate deposits of the region have been found to be blanket deposits occurring in a layer of caliche about 5 in. thick, that lie about 9 in. below the surface of the ground. They are accompanied by other salts, chiefly sodium chlorid. The soil above and the bedrock below the caliche carry only insignificant amounts of nitrate.

It is concluded that the inclined attitude of the bedrock and the thickness of the strata exposed to view render it improbable that rich nitrate beds occur at depth. Contrary to earlier reports, the caliche in general is of poor quality, averaging less than 2.5 per cent of sodium nitrate and being very

unevenly distributed. It is estimated that the Upper and Lower Canyon fields, the most promising parts of the Amargosa region, contain together 168 acres that could produce 1,980 short tons of refined nitrate. It is further concluded that the available quantity of nitrate in this region is so small in comparison with the country's needs and with the cost of production that the region as a whole can not be regarded as of commercial importance.

The manufacture of ammonium nitrate, E. M. SYMMES (*Chem. and Metall. Engin.*, 26 (1922), No. 23, pp. 1069-1074, figs. 5).—A description is given of modern operating practice, and considerations affecting design and operation of ammonia stills, scrubbers, condensers, neutralizing tubs, evaporators, and crystallizing kettles are presented.

Laws governing the phosphoric acid nutrition of plants, M. VON WRANGEL (*Landw. Jahrb.*, 57 (1922), No. 1, pp. 1-78, pls. 2).—The results of an extended series of studies conducted at the Hohenheim Experiment Station, Germany, on the influence of different phosphates on various plants, on the ability of different kinds of plants to assimilate phosphoric acid from different sources thereof, and on the influence of other soil factors on this process are reported.

It was found that plants have quite a variable ability to utilize difficultly soluble calcium phosphates, and they are divided into two groups in this connection. The lime-loving plants are able to assimilate the phosphoric acid from insoluble calcium phosphates in the presence of a weakly alkaline reaction. In proportion to the lime consumption of the plants of this group this action is not hindered by the presence of alkaline or physiologically alkaline calcium salts even in large quantities. The plants of the second group including especially the grain crops are, on the other hand, able to utilize insoluble calcium phosphates only with the assistance of physiologically acid supplementary fertilization or in the presence of an acid soil reaction.

The ratios of the calcium oxid content to the phosphoric acid content in the ashes of these two groups of plants were different throughout. The grain crops shunning lime showed an average calcium oxid-phosphoric acid ratio of from 1 to 3, while the lime-loving crops showed a ratio averaging over 15. The height of this ratio is considered to reflect the ability of different plants to utilize difficultly soluble lime phosphates.

A stoichiometric relation was found to exist between the assimilation of lime and of phosphoric acid by individual plants. In the presence of 1 m of calcium carbonate to 1 m of tricalcium phosphate the yield of oats was reduced to one-half, with 2 m of calcium carbonate to 1 of tricalcium phosphate the yield was reduced to one-third, and with 5 m of calcium phosphate no influence of the tricalcium phosphate could be detected.

The influence of tricalcium phosphate on buckwheat, a lime-loving plant, decreased much more gradually as the calcium carbonate additions were increased. It was not until 600 m of calcium carbonate were used that the ratio of calcium oxid to phosphoric acid in buckwheat ashes reached its maximum and the influence of tricalcium phosphate ceased to exist. Where pure tricalcium phosphate was used on neutral sand free from lime, mustard suffered from lack of lime, while maize suffered from lack of phosphoric acid. In these cases the ash analyses of the mustard showed a relatively high phosphoric acid content and an abnormally low lime content, while those of the maize showed the opposite. These results are taken to indicate that the lime-phosphoric acid factor determined by ash analyses is an indication of the conditions under which assimilation of nutrient by plants takes place in soil and reflects the soil reaction, the lime-phosphoric acid ratio in the soil, and the degree of effectiveness of these soil constituents.

It was found in this connection that in cropping experiments as well as in practice cases can occur in which an apparent but erroneous requirement for

a certain plant nutrient exists in the soil due to improper selection of supplementary fertilization, an alkaline or acid soil reaction, the presence of an excess of lime in the soil, or an improper proportioning of soil nutrients. This is apparently attributed largely to the use of fertilizer salts, which act as catalysts, crop stimulants, reaction changers, solvents, or disinfectants, more strongly than the natural soil nutrients.

The sensitiveness of lupines to lime was successfully combated by proper fertilization with phosphoric acid.

An acid soil reaction was found in general to favor the assimilation of anions by plants, and an alkaline reaction the assimilation of cations. A corresponding removal of the basic or acid portion was indicated by ash analysis. On plants grown in acid soil showed a lime-phosphoric acid factor of 0.6. When grown in neutral soil this factor was 10.

Studies with different plants to determine their sensitiveness to acids or bases in sand soil showed marked individual differences in this respect.

It is concluded that the dependence of the value of calcium phosphates for certain plants on the presence or absence of other lime salts indicates the importance of utilizing other phosphates, such as iron, aluminum, and magnesium phosphates, the assimilation of which by lime shunning plants is not adversely influenced by the presence of lime.

Action of phosphoric acid on soils rich and poor in lime, A RIPPEN. (*Fühling's Landw. Ztg.*, 71 (1922), No. 13-14, pp. 259-265).—This is a critical discussion of the above in which experiments on soils rich and poor in lime are described. It is concluded from these that with reference to the findings of Wrangell either the relation stated between the assimilation of phosphoric acid from calcium phosphates in the presence of lime and the assimilation of lime does not exist or else the soil phosphoric acid exists in forms other than calcium phosphate.

Comparative phosphoric acid fertilization experiment, M HOFFMAN and O NOLTE (*Mitt. Deut. Landw. Gesell.*, 37 (1922), No. 28-29, pp. 442, 443).—The results of experiments on sand, sandy loam, humus sand, clay shale, loam, loamy sand, and heavy soils with different crops, to compare Rhenania phosphate with Thomas meal as a source of phosphoric acid, are summarized. Both phosphates gave profitable increases in the majority of cases, the results sometimes favoring one and sometimes the other. They are considered to be of about equal value as far as their content of citrate-soluble phosphoric acid is concerned.

The utilization of mineral phosphates by crops, O. NOLTE (*Fühling's Landw. Ztg.*, 71 (1922), No. 7-8, pp. 130-133).—A brief review of the results of studies bearing on the subject by different European investigators is presented. The conclusion is drawn that in the use of mineral phosphates as fertilizers the relations of the phosphoric acid to the different soil bases, especially the alkalis, and to the soils themselves are of the greatest importance.

Oxidation of iron pyrites by sulphur-oxidizing organisms and their use for making mineral phosphates available, W. RUDOLFS (*Soil Sci.*, 14 (1922), No. 2, pp. 135-147, fig. 1).—Studies conducted at the New Jersey Experiment Stations on the action of sulphur-oxidizing organisms on iron sulphid and the influence of such action on the availability of rock phosphate composted with a mixture of pyrites, sulphur, and soil are reported.

Evidence was obtained that iron pyrites can be attacked by microorganisms and changed into the sulphate form. The addition of small quantities of sulphur accelerated these changes. Pyrites composted together with sulphur and rock phosphate did not interfere with the gradual increase in the formation of acidity nor with the increase in availability of phosphoric acid.

The replacement of soil with ammonium sulphate in composts in which quantities of sulphur were replaced by iron sulphid produced a marked increase in available phosphoric acid. The effect, when sufficient nitrogen was present for the needs of the microorganisms, is ascribed partly to the catalytic action of the pyrites and the consequent favorable influence on the action of sulphur-oxidizing organisms and partly to the changes from the sulphid into the sulphate form.

Aeration of sulphur-pyrites-rock phosphate compost mixtures by means of a continuous stream of air had little or no beneficial effect upon the production of acidity and consequent availability of soluble phosphoric acid unless ammonium sulphate was added. The action of sulphurous acid in such mixtures seemed to be mainly of a sterilizing nature.

Composition of Stassfurt and Alsatian potassium salts, A. VÜRTHEIM *Dept. Landb., Nijv. en Handel [Netherlands], (Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefsta., No. 26 (1922), pp. 1-8)*—This is a brief chemical comparison of Stassfurt and Alsatian potash salts.

The 20 per cent Stassfurt salt and kainit consist for the most part of a mixture of sodium and potassium chlorids, together with a considerable amount of magnesium and calcium sulphates or magnesium chlorid. They belong either to the so-called hard salt group or to the carnallite group. The 40 per cent potash manure salt is a less contaminated mixture of sodium and potassium chlorids, of which the latter amounts to 40 per cent of the total.

The Alsatian 20 per cent salt contains no magnesium sulphate and only very little magnesium chlorid. It is of uniform composition and consists mainly of ground pure sylvinit mixed with a little clayey material. It reacts weakly alkaline to litmus and effervesces easily with acid. This salt is considered to be of about the same value as the 20 per cent Stassfurt salt.

Evaporation of potash brines at Deep Springs Valley, Calif., L. A. PALMER (*Chem. and Metall. Engin., 26 (1922), No. 22, pp. 1034-1037, figs. 4*).—Methods for recovering potash from natural brines at an experimental plant at Deep Springs Valley, Calif., are described.

The process for separating the different salts contained in the brine is one of boiling out, in which the temperature of the solution is varied and the salts are thrown down in the order of their solubilities. It has been found that above a temperature of approximately 65° C. potassium chlorid has a greater solubility than any of the other salts under consideration. As the solution cools in the crystallizing vats, the potassium chlorid and borax crystallize out together and are removed before the solution has cooled sufficiently to throw down the carbonates and sulphates remaining in the liquor. The potash and borax crystals are heated in their wet state by steam, which causes the borax to dissolve in the water entrained with the crystals and in its own water of crystallization. The potash and dissolved borax are then charged into a centrifuge, and as the centrifuge revolves a jet of wet steam is turned into it to assist in driving the dissolved borax through the filter cloth so that the potash crystals are retained in the cylinder. The product that remains in the centrifuge contains about 2 per cent of water and small amounts of the various salts, other than potassium chlorid, that make up the natural brine.

Water hyacinth ash as a manure and source of potash (Bul. Imp. Inst. [London], 19 (1921), No. 4, pp. 460-462).—Analyses of water hyacinth ash prepared in Burma are presented and discussed.

The results, together with those of other studies, are taken to indicate that the amount of potash in water hyacinth ash varies largely with the conditions under which the plant grows. The samples in question contained a large

percentage of insoluble matter, partly in the form of sand or soil. This ash is considered to be suitable for use as a potash manure. The presence of a little phosphoric acid adds slightly to its manurial value. The original ash contained 7.54 per cent of potassium chlorid and 8.2 per cent of calcium phosphate, which was included in the insoluble portion. The ash is said to differ materially from that obtained from most varieties of wood, in that its chief water-soluble constituent is potassium chlorid, while in wood ash the potash is present largely as potassium carbonate.

Inspection of fertilizers, P. S. BURGESS ET AL. (*Rhode Island Sta. Ann. Fert. Circ.*, 1922, pp. 14).—This circular contains manufacturers' guaranties and actual analyses of 108 samples of fertilizers and fertilizer materials collected for inspection in Rhode Island during 1922.

AGRICULTURAL BOTANY.

The distribution of vegetation in the United States, as related to climatic conditions, B. E. LIVINGSTON and F. SHREVE (*Carnegie Inst. Wash. Pub.* 284 (1921), pp. XI+590, pls. 3, figs. 144; in *Geogr. Rev.*, 13 (1923), No. 1, pp. 154-156).—In this publication an attempt has been made to correlate the distribution of the vegetation of the United States with climatic conditions that appear of importance to plants. The study has been made quite largely from the standpoint of the plant physiologist, and as far as possible attention has been centered on those climatic features, such as temperature, moisture, and light, that are believed to influence plant activity directly. The possibility of other factors, such as soil conditions, influencing plant distribution, are recognized, but the present state of information is not considered sufficiently definite to warrant general conclusions as to these influences. As a consequence the studies have been restricted to the consideration of those conditions which are believed to be effective above the surface.

The authors recognize, "as a law of plant geography, that the existence, limits, and movements of plant communities are controlled by physical conditions. The conditions that control the movements of the community are those of the soil; the conditions that control the broader geographic limits are almost entirely those of the climate."

In the introduction the authors state that "the physiological point of view has been constantly held before us in planning and carrying out the complicated comparisons and correlations with which the present publication deals." In part 1 is shown how the numerous vegetation features employed were derived, while part 2 deals with the principles and methods by which the climatic features used were selected. These are set forth under the headings of general influence of the environment on plant life, chief environment conditions and the general nature of their effects upon plants, and the climatic conditions in the United States. The publication gives detailed accounts as to the distribution of certain types of vegetation and certain species of plants in the United States, as well as data to show the intensities of the leading climatic conditions in the United States, and correlates these two bodies of facts in such a manner as to bring out the exact range of conditions under which each plant or vegetation lives with respect to each of the climatic elements.

The influence of light on the geotropic reaction, C. E. B. BREMEKAMP (*Rec. Trav. Bot. Néerland.*, 18 (1921), No. 4, pp. 373-439, pls. 3, figs. 9).—A continuance of the study previously noted (*E. S. R.*, 35, p. 632) is reported in considerable detail as applied to coleoptiles of *Avena* subjected to the combined influences of light and gravity.

Transport of organic substances in plants, H. H. DIXON (*Nature [London]*, 110 (1922), No. 2764, pp. 547-551).—In the presidential address before the botany section of the British Association, a review is given of the evidence and arguments bearing upon transportation of organic substances in plants.

It is concluded that the transportation of the organic substances needed in the distal growing scions is effected through the tracheae of the wood. The substances travel dissolved in the water which fills these channels and which is moved by transpiration, expansion of the growing cells, or root pressure. Physical conditions preclude sufficiently rapid transport in the bast for either the observed upward or the downward distribution of organic substance. The existence of downward as well as upward movement of water in the tracheae of the wood may be demonstrated by suitable experimental means, and may be inferred by the transport of hormones in the wood. The occurrence of local contractions in leaves suggests that local increases of permeability supply dissolved organic substances to the distal ends of certain of the filaments of tracheae. The tension developed by the transpiration of other regions draws these along downward as well as upward channels in the wood.

As to the probable function of the bast, it is said that its distribution and conformation are such that, while it possesses a very small cross section, it appears with the other living elements of the vascular bundles, medullary rays, wood parenchyma, etc., to present a maximum surface to the tracheae. This large surface may find explanation in the necessity of interchange between the living cells and dead conduits. The colloidal contents of the former render this process slow, hence the necessity for the large surface of interchange to enable sufficient quantities of organic substances to be abstracted from and introduced into the tracheae to meet the needs of the plant.

On the changes of volume in a mixture of dry seeds and water, A. J. EWART (*Roy. Soc. Victoria, Proc., n. ser.*, 34 (1922), No. 2, pp. 172-179).—Experimentation investigating the changes of volume occurring when dry seeds absorb water shows that if the seed coat wrinkles there is first an expansion, then a contraction, and then a final rise due to the production of gas in the seed. The changes are not the result of alterations of temperature. The wrinkling is due to unequally rapid absorption, partial vacuums forming under the wrinkles which hasten the indrawal of water. If the seed coat does not wrinkle there is no preliminary expansion, and the contraction is due, as in gelatin, to the compression of absorbed water.

Using similar methods with gelatin as with seeds, the contraction obtained indicated a pressure of 20 atmospheres, though with seeds pressures as high as 50 to 120 atmospheres were indicated. It is thought this may be due partly to the greater imbibition pressure of organized cellulose as compared with gelatin, and partly to the influence of solutes increasing the internal pressure of the water within the seeds.

Chemical changes in wheat during germination, H. A. CHOATE (*Bot. Gaz.*, 71 (1921), No. 6, pp. 409-425, pl. 1, figs. 2).—This investigation is an attempt to determine somewhat more comprehensively the principal chemical changes occurring in a single kind of normally germinating seed, and thus to contribute to the facts of germination in general, and at the same time to provide a possible basis of comparison for some of the still unsolved problems of delayed germination and afterripening.

The principal storage carbohydrate of Marquis wheat is starch in the endosperm. A small amount of sucrose is also present in the endosperm and embryo.

The first noticeable chemical change during germination is the appearance of dextrin in the scutellum and coleorhiza, and of starch in the rootcap. These

substances appear simultaneously after about 10 hours in the germinator (16 to 20° C.). Later dextrin appears in the coleoptile and plumule. Reducing sugar (probably all glucose) appears in the embryo after 18 hours in the germinator, being found first in the coleorhiza, but appearing soon afterwards in all parts of the seedling, especially the zone of root hairs and coleoptile. During the germination period studied, the increase in length of epithelial cells averaged 150 per cent. Peroxidase and catalase are present in all parts of the grain both before and during germination. Catalase increases during the first 7 days at a rate corresponding to the rate of increase in the respiratory activity. During germination the protein content of the endosperm decreases greatly, except in case of the aleurone layer. Microchemical analyses show the presence of amino acids in ungerminated grain and their increase in amount during germination, but they fail to indicate any amino nitrogen until the fourth day of germination. Asparagin is the only form that can then be so identified. This appears only in the root and coleoptile, accumulating in the latter in considerable quantity.

The development of endosperm in cereals, M. GORDON (*Roy Soc. Victoria, Proc., n. ser., 34* (1922), No. 2, pp. 105-116, figs. 9).—The author has attempted to trace the development of the aleurone layer and the starchy endosperm in some of the more common cereals, and to show whether or not the starchy endosperm is developed from the aleurone layer, that is, to prove whether or not the aleurone layer is really an endospermic cambium. The work is described in detail.

It is stated that the first formed endospermic cells of cereals are derived from the secondary nucleus of the embryo sac. The nuclei so formed pass to the walls of the embryo sac where they form a lining layer. Later the nuclei become inclosed by cell walls so that the embryo sac is lined with a single layer of cells. This lining layer assumes the character of a cambium, which produces segment cells only on its inner surface. The cells enlarge, remain thin walled, and become packed with starch to form the starchy endosperm. After division in these cells has ceased, they become filled with aleurone grains and thicken their walls, forming the aleurone layer. The greater respiratory activity of this layer and the presence of vitamins therein are the natural results of its being a resting cambium. The question whether it can be awakened to further activity during germination remains for future investigation.

The natural coloring matters of plants, J. H. WURDACK (*Trillia, No. 6* (1919-1921), pp. 1-14).—Of the large number and variety of coloring matters in the plant world, this article is confined to a few found widely distributed.

Chlorophyll, the practically universal green plant coloring material, is insoluble in the cell sap and occurs in the chloroplasts. The carotinoids appear as yellow, orange, or reddish pigments and include carotin, xanthophyll, lycopin, and fucoxanthin. They are insoluble in the cell sap and occur either in a relatively pure form in the chromoplasts or associated with chlorophyll in the chloroplasts. The anthoxanthins include a number of yellow pigments sparingly soluble in water but soluble in acids or alkalis forming yellow to red solutions. The anthocyanins constitute the red, violet, or blue colors of flowers, many fruits, and some leaves. These general classes are discussed with their numerous subdivisions.

The work is still progressing. Anthocyanins, recently discovered as named, include betanin from red beets to the extent of 0.22 per cent of beet meal (the anthocyanidin being betanidin); raphanin from radish peelings (the anthocyanidin being pelargonidin); rubin, a diglucoside of cyanidin, from a dark

violet variety of radish; and rhinanthocyanin, a product of the hydrolysis of rhinanthin, a glucosid in the seeds of *Alectorolophus hirsutus*. Free anthocyanidins are reported in the flowers of *Pelargonium* and of *Papaver rhoeas*, in the red or olive leaves of *Prunus pissardii*, and in the fruits of *Ruscus aculeatus* and *Solanum dulcamara*.

The physiological significance of anthocyanin. W. GLEISBERG (*Ber. Höher. Staatl. Lehranst. Obst u. Gartenbau Proskau, 1920-1921, pp. 87-93*).—Studies applied to *Vaccinium oxycoccus*, which has anthocyanin coloring matters in blooms, fruits, and winter leaves, indicate that the behavior of anthocyanin is not uniform even in the same plant, different parts of which may show different chemical processes in connection with this colorant.

An interim census of cyanophoric plants in the Queensland flora. F. SMITH and C. T. WHITE (*Roy. Soc. Queensland, Proc., 30 (1918), pp. 84-90*).—This paper, presenting the results of observations begun in 1914 and continued with intermissions until 1918, is regarded as extending the work done in the same field by others mentioned. The list comprises nearly 70 indigenous species in 22 genera which have been definitely shown for the first time to be cyanophoric in Australia.

On the occurrence of cyanophoric glucosids in the flowers of some Proteaceae. F. SMITH and C. T. WHITE (*Roy. Soc. Queensland, Proc., 32 (1920), pp. 89-91*).—Summarized accounts are given of the reactions of the floral parts of the various Proteaceae examined since the publication of the paper above noted.

The culture of ergot. L. HECKE (*Schweiz. Apoth. Ztg., 59 (1921), Nos. 21, pp. 277-281; 22, pp. 293-296*).—An account is given in condensed form of *Claviceps purpurea* (*Secale cornutum*, *Sclerotium clavus*) and its specialization on wild and on cultivated (economic) grasses.

Rise in temperature of living plant tissue when infected by parasitic fungus. I. B. P. and M. P. EVANS (*Nature [London], 110 (1922), No. 2762, pp. 480, 481*).—While investigating the effects of inoculating oranges and grapefruit with *Penicillium digitatum*, the authors found that a very definite rise of temperature took place in the infected tissue, and they raise the question whether a similar rise of temperature takes place in all cases where living plant tissue is attacked by parasitic fungi or bacteria. As regards possible causal host reaction, no rise of temperature was observed when the host tissue was killed prior to inoculation.

A note on the morphology of bacteria symbiotic in the tissues of higher organisms. I. E. WALLIN (*Jour. Bact., 7 (1922), No. 5, pp. 471-474*).—During a study of the cytoplasmic relationships of bacteria in white clover, the author observed a stage in the morphogenesis of *Bacillus radicicola*, regarding which scant mention appears in the literature. It is not yet evident whether these rounded forms, which are tentatively called senile, are derived from the branched forms or from the symplasm. These forms are fragile and are usually destroyed in the ordinary bacteriological technique.

The method of handling employed is outlined as potentially valuable in bacteriological research.

Salt effects in bacterial growth.—II, The growth of *Bacterium coli* in relation to H-ion concentration. J. M. SHERMAN and G. E. HOLM (*Jour. Bact., 7 (1922), No. 5, pp. 465-470, figs. 2*).—In order to ascertain to what extent the action of neutral salts employed in the work previously noted (E. S. R., 47, p. 524) is affected by various H-ion concentrations, experimentation was carried out in which the growth rate of *B. coli* was determined by the time elapsing between inoculation and turbidity. The medium was 1 per cent pep-

tone with an addition of various amounts of salts, the H-ion concentration being adjusted by the use of concentrated HCl and NaOH solutions. The results are presented in tabular and graphical form, with discussion of the varying effects of the salt solutions employed.

Teratological phenomena following traumatism, M. MOLLIARD (*Compt Rend. Acad. Sci. [Paris]*, 172 (1921), No. 8, pp. 473-475).—*Daucus carota* showed abnormal inflorescences characterized by doubleness, apetalousness, virescence, and proliferation.

Effects of copper wire on trees, G. B. RIGG (*Science*, 56 (1922), No. 1459, p. 687).—In order to determine the effect of driving copper wire into trees, the author in March, 1919, drove five pieces of large copper wire 1.5 in. long into two hemlocks, two alders, one cedar, and one willow. The trees were from 2 to 4 in. in diameter at the time the copper wire was driven into them, and in July, 1922, they were examined and found to be perfectly healthy. In all cases the wound had completely healed over, and their growth was equal to that of similar trees in the immediate vicinity. On cutting into the trees it was found that there was little injury to the wood, merely a brown color showing for about 1.5 in. above and below the wire, and about 0.25 in. on either side.

Sterility in wheat hybrids, K. SAX (*Genetics*, 6 (1921), No. 4, pp. 399-416; *abs. in Maine Sta. Bul.* 304 (1921), pp. 345-347).—The results are given of a study of the sterility relationship in wheat as shown by the endosperm development in fertile and sterile crosses, sterility in species crosses as determined by grains set and pollen counts, hybrid vigor of F_1 plants in relation to sterility, and size and variability of pollen grains in parents and F_1 plants.

Studying some of the principal groups of wheats, the author reports that the varieties in the einkorn group are interfertile but are sterile or only slightly fertile with the emmer and vulgare groups. The species and varieties of the emmer group are interfertile but are sterile or only slightly fertile with the einkorn group and partially sterile with the vulgare group. The vulgare groups of wheats are interfertile, but they are sterile or only slightly fertile with einkorn wheats and partially sterile with the emmer group.

The data are said to show that the size of the pollen grains varies in different species of *Triticum*, and that pollen grain size is closely correlated with the sterility relationships of the three groups mentioned above. The size of pollen grains is said to have little or no effect on the percentage of grain set in crossings. Pollen grains of the F_1 plants were found to be more variable than those of the parents, presumably due to recombinations of chromosomes in the haploid generations.

A varietal cross within the vulgare group is said to have produced F_1 plants which failed to develop beyond the rosette stage, presumably due to lethal or inhibiting factors.

FIELD CROPS.

[Report of plant breeding work in Arizona], W. E. BRYAN and E. H. PRESSLEY (*Arizona Sta. Rpt.* 1921, pp. 601-605, fig. 1).—Pure-line studies with alfalfa were continued as heretofore (*E. S. R.*, 45, p. 435). Observations indicated that caging alfalfa plants interferes to some extent with seed setting. However, the amounts of seed set on different plants under the cages varied considerably.

The inheritance of grain texture of the Sonora-Turkey cross noted earlier is supplemented by an account of the inheritance of earliness through four generations. The mean heading date of pure Sonora plants in 1918 was April 7;

of pure Turkey plants, May 1; and of F_1 plants of the Sonora-Turkey cross the same season, April 18. The range of heading dates of 4,892 F_1 plants from 30 families covered a period of 36 days, 3 days more than the period between the appearance of the earliest head on the early Sonora and that of the latest head on the late Turkey. Only 66 of the F_1 plants headed as early as the latest head on Sonora, while 1,435 F_1 plants headed as late as the earliest head of Turkey. F_1 plants grown from seed of the early F_1 plants of the family indicated had a mean heading date of March 27, while that of plants of Sonora was March 25. F_1 plants from seed of F_1 early plants had a range of heading dates 5 days narrower than that of Sonora. Intermediate selections in both F_2 and F_4 had ranges of heading dates about the same as that of the F_1 . Late races as late as Turkey were also separated. The large number of true breeding intermediate races separated indicated the possibility of fixing a race with any degree of intermediacy with regard to earliness, provided enough F_1 plants are grown.

[Report of the] **Scottish Society for Research in Plant Breeding**, M. DRUMMOND (*Scot. Soc. Research Plant Breeding, Rpt., 1 (1922), pp. 36, pl. 1, figs. 2*).—Besides a general outline of the research policy of the society, detailed results are given concerning work in 1921 at Corstorphine near Edinburgh, Scotland, with pure lines, hybrids, and commercial strains of oats, wheat, and barley varieties, potato varieties and seedlings, swedes, turnips, and miscellaneous crops.

[Report of field crops work in Arizona, 1921], G. E. THOMPSON, R. S. HAWKINS, and S. P. CLARK (*Arizona Sta. Rpt. 1921, pp. 564-570, figs. 3*).—In continuation of previous work (*E. S. R., 45, p. 429*) are described variety and cultural tests with grasses, legumes, wheat, barley, corn and sorghums; fertilizer tests with wheat; and cultural and fertilizer trials with Egyptian cotton. Outstanding varieties included purple and hairy vetch, tepary beans, hegari, Sumac sorgho, Mexican June corn, Baart wheat, Beldi and Mariout barley, and Abruzzi rye. Rhodes grass promised considerable value as a pasture crop on the alkaline soils of the lower valleys. Although Napier grass gave a large yield, it was deemed less desirable than the common varieties of sorghum. In accord with earlier results, no appreciable difference was observed between crops grown in dynamited soil and in soil not so treated.

[Experiments with field crops at Bari, Italy, 1919-1921], E. PANTANELLI ET AL. (*Bari Staz. Agr. Sper. Relaz., 1 (1919-1921), pp. 27-63, pls. 6, fig. 1*).—Varietal trials with wheat, barley, corn, grain sorghums, and sorgho, conducted at Bari, Italy, are described, and notes are given on field tests of oats, rye, miscellaneous legumes for seed and forage, fiber and oil seed plants, tobacco, and sugar beets. Comparisons of forage grasses for pasture purposes and drought resistance are also included.

[Report of field crops work in Mysore, 1919-20] (*Mysore Dept. Agr. Rpt., 1919-20, pp. 4-11, 21-26, 33, 34, 41-43, 59, 60, 65-71*).—Cultural and fertilizer experiments with sugar cane, ragi, and rice, and varietal trials and breeding work with sugar cane, ragi, rice, and cotton are described, and field tests of miscellaneous crops are noted as heretofore (*E. S. R., 44, p. 137*).

Rice responded well to the use of the green manures, sunn hemp and honkey leaves. The addition of bone meal to green manure resulted in a distinct increase in yield. A combination of ammonium sulphate and superphosphate gave the best results, while the addition of potassium sulphate had a depressing effect on the yield.

Sixty per cent of the water-holding capacity of the soil was the optimum amount of water needed for ragi, jola, and sunn hemp in pot culture work re-

ported by H. V. Krishnayya. Crops receiving fertilizer required relatively less water than those unfertilized, for the same amount of dry matter produced. Sunn hemp did not respond to fertilizer as well as ragi and jola.

Some useful introduced fodder plants, E. BREAKWELL (*Agr. Gaz. N. S. Wales*, 33 (1922), No. 7, pp. 485-490, figs. 2).—Notes on the characteristics and uses of the plant and its adaptations in New South Wales are given for tagasaste (*Cystisus proliferus*), sainfoin, sulla, teosinte, lespedeza, kudzu, and sheep's burnet.

[Experiments with Irish potatoes and sweet potatoes], F. J. CRIDER, A. F. KINNISON, and D. W. ALBERT (*Arizona Sta. Rpt. 1921*, pp. 592, 593).—Peach Blow, White Rose, and Early Rose potatoes yielded 7,602, 1,504, and 2,457 lbs. per acre, respectively, at Yuma when planted on ridges preventing irrigation water contact with the tubers, and made 5,901, 1,428, and 3,730 lbs., respectively, when planted level. All varieties matured from 7 to 9 days earlier with the ridge method.

Porto Rico sweet potatoes stored in an adobe house at the Salt River Valley farm lost only 2 per cent from November to April and retained good quality. Stored from October to March at Tucson, Porto Rico lost 13.8 per cent and Nancy Hall 15.1 per cent, the most shrinkage being noted with the smaller roots. One hundred and seventy-five lbs. of Nancy Hall sweet potatoes were found to be sufficient to produce plants to set an acre where the potatoes are planted whole and the plants set 18 in. apart in rows 3.5 ft. apart.

The spring catch of clover and grass, M. E. MCCOLLAM (*Western Washington Sta. Bmo. Bul.*, 10 (1923), No. 5, pp. 90, 91).—Directions are given with mixtures for spring seeding clover and grass both for permanent pasture and hay on land under different situations and cultural conditions.

Permanent pastures for the northern half of Georgia, P. TABOR (*Ga. Agr. Col. Bul.* 261 (1922), pp. 28, figs. 15).—The characteristics and cultural requirements of the principal and supplemental pasture plants adapted to the northern half of Georgia are indicated, with notes on the prevalence of native grasses and weeds and on pasture lands and systems.

Border effect and ways of avoiding it, A. C. ARNY (*Jour. Amer. Soc. Agron.*, 14 (1922), No. 7, pp. 266-278).—Further studies of border effect in tests of cereals were carried on at the Minnesota Experiment Station (E. S. R., 45, p. 528).

In 1921 an increased yield was found in the outside and middle borders for the winter wheat varieties where the alleys were not cropped and for the spring grain separated by alleys cropped to winter wheat. The effect on the inside border rows was nil for the winter wheat and slight for the spring wheat. Cropping the alleys between plats of spring grains to winter wheat reduced border effect so that it was not plainly evident before harvest. The three-year average of yields of the outside rows of oats, spring wheat, and barley based on the yields of the central rows was 199.8, and that of the middle border rows 138.

When varieties were separated by alleys in plats for a three-year period, the removal of the outside border row from either side of each plat reduced yields about 10 per cent, and removal of two border rows from either side of each plat reduced yields about 17 per cent. The border effect extending to the third row (inside border row) was relatively unimportant.

That border effect in plats separated by uncropped alleys makes a different interpretation of results necessary in some instances has been shown. The fact that in each year one or more varieties or rates of seeding was moved to the other side of the discard point for the year by the removal of border rows indicates that this operation was necessary to secure reliable results.

Under other conditions this may not be required. "The knowledge that border effect is not uniform for all varieties precludes the use of any percentage figures derived in one place to reduce yields secured in another location to a border-effect-free basis."

Sources of error in sampling grain. W. L. FRANK and R. L. CAMPBELL (*Sherman, Texas: Authors, 1922, pp. 10; abridged in Amer. Elevator and Grain Trade, 41 (1922), No. 5, pp. 336, 337*).—Analyses of numbers of samples of wheat, oats, corn, and grain sorghums were made as customary for determining the market grade in order to compare different methods of reducing original samples to 1,000 gm.

The kind and character of the grain, the nature and amount of foreign material present, the relative size and shape of individual kernels composing the greater part of the sample, the relative specific gravity of the constituents, and the size of the original sample may affect the relative percentages of grain and of other materials in samples obtained from the same source by different methods of sampling. Large interspaces between kernels and relatively fine heavy foreign material or broken grain are also conducive to large variation. Recommendations to overcome non-uniform grading are outlined.

Some comments on grain sampling (*Amer. Elevator and Grain Trade, 41 (1922), No. 6, p. 401*)—Brief discussions of the above by terminal grain inspectors.

A comparison of some physical properties of immaturesly frosted and nonfrosted seeds of wheat and oats, J. R. FRYER (*West Canad. Soc. Agron. Proc., 2 (1921), pp. 46-56, figs. 3*).—Results from preliminary experiments at the University of Alberta pointed to tentative conclusions which can be summarized as follows:

Oats in the dough stage, subjected to 13° F., probably suffer a slight shrinkage in size of caryopses, whereas shrinkage is not indicated with wheat subjected to the same freezing. The volume of oat kernels is probably reduced by freezing, but that of wheat kernels seems to continue to increase if left to grow. Freezing does not seem to change the density of oat and wheat kernels appreciably, except with very immature wheat, when reduction is noted. While tests of weight per 1,000 kernels were inconclusive, wheat frosted by 13° F. at the pale yellow stage of maturity seems to continue to gain weight when permitted to stand. Frosted wheat exposed to ordinary atmospheric conditions does not appear to retain its moisture to the same extent as nonfrosted wheat.

As compared with normal wheat, frosted wheat has a more variable color, from light amber to bronze or green; a duller luster; a transversely wrinkled surface; a slightly more brittle endosperm; and less closely attached outer layers of the seed coat. Frosting tends to fix the greenish color of oats, particularly at the germ end, if the grain is quite immature, and increases the brittleness and frequently darkens the interior of the endosperm as well as the strand of tissue traversing the bottom of the groove. Frosted wheat appears to suffer a loss in hardness. Freezing probably does not destroy the semipermeability of the integument, as frosted seeds absorbed more rapidly and larger amounts than nonfrosted seed. The less mature the wheat was when exposed to freezing, the greater was the increase occasioned in absorptive capacity and the greater the effect on the kernel.

Grains grown in combination for grain production, C. A. ZAVITZ (*Jour. Amer. Soc. Agron., 14 (1922), No. 6, pp. 225-228*).—In experiments at the Ontario Agricultural College, where different classes and varieties of grain were grown in combinations and the resultant crop separated into its different factors, the greatest influence on production was exerted by oats and barley.

The maximum acre yield of grain was secured by seeding the mixture of 48 lbs. of barley and 34 lbs. of oats per acre. The use of either a six-rowed barley with an early oats or a two-rowed barley with a late maturing oats is indicated. The addition of another cereal to a standard mixture of oats and barley has reduced the total yield of grain. Practically no advantage was observed when different varieties of the same class of grain were grown in combination.

The irrigation of barley, F. S. HARRIS and D. W. PITTMAN (*Utah Sta. Bul.* 178 (1922), pp. 3-19, figs. 10).—The crop growth of barley at the Greenville Experimental Farm was divided into 4 stages: Five leaves with plants 6 to 8 in. high, early boot stage prior to exsertion, bloom, and dough stage. Five-in. applications of water were given in such combinations as to include each stage, each two stages, each three stages, and all four stages. Water was also applied to barley at rates of 1, 2.5, 5, and 7.5 in. each week during the season.

The highest yield was produced with three 5-in. irrigations applied at the 5-leaf, boot, and bloom periods of growth. The plat receiving 2.5 in. each week, totaling 17.5 in., yielded better than those with larger or smaller weekly applications. Fifteen in. of irrigation water produced a greater yield than did a larger quantity. Water applied after planting and before the grain was up decreased the yield as compared to an unirrigated plat. Early irrigations, when not applied before the crop shaded the ground, were generally more effective than those made later. Water applied when the grain was filling or in the dough stage increased the yield but little. Excessive irrigation decreased the ratio of grain to straw and retarded maturity. Twenty acre-inches of irrigation water over 4 acres produced over 3 times as much barley as where all was used on 1 acre.

The effects of the different treatments on the height of plants and on the density of stand were in general agreement with the yield. The plat receiving 2.5 in. per week had the tallest grain and the most tillering. Of the plats watered at different stages the early irrigations seemed to be more effective in producing tall grain and a dense stand. In general, the plats receiving 15 in. or more of irrigation water had heavier grain than the others. As a rule the heaviest individual kernels were also produced on these plats. The average length of head and number of spikelets and kernels per head were not definitely correlated with either the yield or the irrigation treatment. However, the length of head generally followed the straw yield.

A classification and detailed description of some of the barleys of Australia, A. J. EWART ET AL. (*Aust. Inst. Sci. and Indus. Bul.* 22 (1922), pp. 33, figs. 10).—The present publication, similar to that on wheat already noted (E. S. R., 44, p. 439), classifies and describes 35 varieties of barley grown in the Commonwealth. The information regarding agricultural characters was largely obtained from J. T. Pridham of the Cowra Experimental Farm, New South Wales.

Scarred endosperm and size inheritance in kernels of maize, W. H. EYSTER (*Missouri Sta. Research Bul.* 52 (1922), pp. 3-10, pls. 2, figs. 2).—Scarred endosperm, a new character in corn which consists in an irregular cavity in the endosperm on the abgerminal side of the kernel, appeared among plants segregated by F₁ progenies of plants with unusual chlorophyll patterns. Kernels with scarred endosperm usually have a rough indentation and are smaller than kernels with normal endosperm. Data from studies of scarred × normal showed scarred endosperm to be inherited as a simple Mendelian recessive character. Correlated with scarred endosperm is a difference in size

of kernel apparently due to the same factor. The factor pair for scarred endosperm is designated by the symbols *Sc sc*.

Alteration of names of maize varieties, H. WENHOLZ (*Agr. Gaz. N. S. Wales*, 33 (1922), No. 8, p. 544).—Northwestern Dent and U. S. Sel. 133 are recommended for the coldest portions of the northern table-land in New South Wales under the names of Sundown and Early Morn, respectively.

Growth and abscission in Sea Island cotton, T. G. MASON (*Ann. Bot. [London]*, 36 (1922), No. 144, pp. 457-484, figs. 14).—Studies of the external and internal factors affecting the shedding of bolls and flower buds by Sea Island cotton in St. Vincent are reported. See also earlier work by Harland (*E. S. R.*, 40, p. 627).

The proportion of shedding over any given period is concluded to be the resultant of two opposing factors, the rate at which food was synthesized by the plant and the rate at which it was utilized in the maturation of the fruit. Any check in the first augmented the rate of shedding. It is emphasized that any factor which injures the boll—fungus and bacterial diseases, insect depredations, etc.—causes the shedding of the boll, provided the injury is so pronounced as to interrupt the translocation of food into the boll.

Gin damage to cotton, G. BRIGGS (*Okl. Agr. Col. Ext. Circ.* 157 (1922), pp. 4).—Attention is called to the heavy penalties suffered by Oklahoma cotton because of gin damage, and instructions are given to avoid this loss, which may run as high as \$25 per bale. Direct gin damage may be caused by damp cotton, speeding or crowding the gin, tight roll, or sharp, rough saws. Indirect gin damage is considered to be the forming of "two-sided bales" and mixing of seed.

Linen, A. S. MOORE (*London: Constable & Co. Ltd.*, 1922, pp. VIII+205, pls. 16).—A general exposition of the linen industry embracing an historical account; a discussion of the present linen trade and world flax supply; field practices in producing flax; the preparation and spinning of the fiber; weaving, finishing, and marketing cloth; and flax organizations.

Hemp-grading service, W. H. FERRIS (*New Zeal. Dept. Agr. Ann. Rpt.*, 1920-21, pp. 50-53).—Defects in washing and bleaching fiber and dressing the leaf, and unsatisfactory scutching are described as causes for the decline in quality of phormium fiber in New Zealand. The number of bales of various grades at the several grading ports are tabulated.

Varietal trials with oats in North Dakota, T. E. STOA (*North Dakota Sta. Bul.* 164 (1922), pp. 47, figs. 7).—Available yield and agronomic data from comparative trials with varieties of oats at the station and substations in cooperation with the U. S. Department of Agriculture are tabulated and discussed. Comparative estimates of stem-rust infection are given for the principal varieties at Fargo and Dickinson, as well as descriptive notes on the leading sorts.

The outstanding varieties include Sixty-Day and Kherson of the early oats; Lincoln, Victory, Siberian, and Early Mountain of the midseason group; and White Russian and Tartarian among the late varieties.

Midseason varieties seem to be generally better adapted for the whole State than the early or late varieties. In southern and eastern North Dakota, early varieties often equal and sometimes outyield midseason or late sorts. In the central and western parts of the State midseason varieties are better adapted. Late oats are considered as restricted in their adaptation to the northeastern part of the State.

Early varieties produce the least straw and late varieties the most straw. Differences between varieties within a group are not marked. Early varieties

mature in from an average of 75 to 80 days after emergence and before the general wheat-harvesting season, and are preferred as a nurse crop. Midseason varieties mature about 10 days later, and late varieties, needing 20 days more than the early, immediately follow the wheat-harvesting season. Early oats are not as heavy per bushel as normally maturing midseason or late oats, but have a greater proportion of kernel to the hull. Under normal conditions oats grown in western North Dakota test higher than when grown in the Red River Valley.

Stem rust sometimes causes serious injury to oats, especially in eastern North Dakota. Although early varieties are not resistant, they often escape rust infection. Midseason varieties, particularly Swedish Select, are susceptible. White Russian and Tartarian exhibit resistance to stem rust.

Plat competition with potatoes, B. A. BROWN (*Jour. Amer. Soc. Agron.*, 14 (1922), No. 7, pp. 257, 258).—A positive correlation of 0.271 ± 0.053 was found in comparisons of the Green Mountain check with adjacent single-row potato plats, 3 ft. apart, with seed 12 in. apart in the row, at the Connecticut Storrs Station. Considering the conditions of the experiment, it is concluded that yields of potatoes are not influenced by competition between single-row plats. Competition between varieties of soy beans and between varieties of oats is also described.

Potato variety trials on different soil types, F. BRÜNE (*Illus. Landw. Ztg.*, 42 (1922), No. 63-64, pp. 259, 260).—Improved and commercial varieties of potatoes were compared on high moor, sand, and marsh soils near Bremen. Kameke Parnassia gave high yields on all soil types, and recently improved varieties showed their suitability to moor land.

Thieles Kuckuck, with 484 bu. per acre, averaged highest among the early sorts, and Kameke strains of Pepo and Parnassia, with 576 bu. and 555 bu. per acre, respectively, led the late varieties. Parnassia with 19.8 per cent, Kleinspiegeler Wohltmann with 18.3 per cent, and Thieles Kuckuck with 18 per cent were foremost in starch content. The improved sorts showed a very low percentage of starch on high moor land. The starch content of early varieties averaged 12 per cent on high moor, 15.2 on sand, and 17 per cent on marsh soil, and later sorts on these soils contained 14.8, 17.6, and 17.5 per cent, respectively.

Can ripened potato tubers develop further? ZADE and K. CHRISTOPH (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 4, *Wirtschaft.-Prakt.*, pp. 163-168).—Comparisons of tubers stored in moist and dry soils suggest an explanation of the apparent growth occurring after the death of the plants. Potatoes harvested late in the fall retain more moisture and soil than those harvested earlier. The amount of precipitation is greater in late fall than in late summer and early fall, giving such conditions that tubers in the soil suffer no shrinkage whereas those in cellars and heaps soon become lighter.

Fertilizing sugar beets with superphosphates in 1921, O. KYAS, J. PITRA, and J. URBAN (*Ztschr. Zuckerindus. Czechoslovak. Repub.*, 46 (1922), No. 39, pp. 463-470).—Sugar beets, fertilized with 40 kg. of nitrogen and 80 kg. of potash per hectare (35.6 and 71.2 lbs. per acre, respectively), alone, and with 50, 75, and 100 kg. of phosphoric acid as superphosphate, were compared with untreated beets at 34 localities in Czechoslovakia in 1921.

Although the fertilized plats gave noticeable increases over the untreated parcels in yield of beets, the increases caused by the different phosphorus applications were neither large nor consistent. The smallest phosphorus application produced a decided gain in leafage as compared with the nitrogen and potash alone, but the heavier applications were not so effective in this respect. Practically no variation was noted in the average sugar content of the beets

regardless of the treatment. Dry weather and other unfavorable conditions affected the results considerably.

Concerning yield deterioration in the older sugar countries, M. BIRD (*Internatl. Sugar Jour.*, 24 (1922), No. 284, pp. 406, 407).—Extensive observations in various sugar countries and especially in British Guiana suggest to the author that the diminished yields and the susceptibility of sugar cane to disease and insect pests are largely due to the lack of available plant food, a condition to be remedied by proper fertilizer treatment following soil analysis.

Hubam clover (*Melilotus alba annua*), H. A. MELLE (*Union So. Africa Dept. Agr. Jour.*, 5 (1922), No. 4, pp. 321–325, figs. 2).—Observations at Pretoria and Groenkloof Botanical Stations showed Hubam sweet clover to be desirable to grow with kikuyu grass. It renovated the latter, supported the slender stems, and prevented the grass from becoming sod bound. Hubam showed greater frost resistance than barley, alfalfa, and common clovers and is indicated as a substitute for cowpeas. Seeding at different dates enabled the clover to flower throughout the year.

A species of *Trifolium* behaving like berseem, A. FIORI (*Agr. Colon [Italy]*, 15 (1921), No. 8, pp. 413–415, pl. 1; trans. in *Internatl. Inst. Agr. [Rome]*, *Internatl. Rev. Sci. and Pract. Agr.*, 12 (1921), No. 12, pp. 1548–1550).—*T. squarrosum*, a Mediterranean species said to be closely related to berseem (*T. alexandrinum*) but with a wider distribution and apparently greater adaptability, is described, and its habitat is indicated.

Wheat investigations.—II, Correlations between various characters of wheat and flour as determined from published data from chemical, milling, and baking tests of a number of American wheats, J. ZINN (*Abs. in Maine Sta. Bul.* 304 (1921), pp. 351, 352).—The data presented concern the relationships existing between crude protein, dry gluten, gliadin, water absorption, flour yield, and loaf volume for the wheats found in different parts of the country. An earlier contribution (*E. S. R.*, 43, p. 641) considered pure lines.

Crude protein content in the wheat is very closely and consistently correlated with protein in flour, dry gluten, and gliadin. Practically no relation is apparent between crude protein content in the wheat and flour yield. With some notable exceptions, a high positive correlation exists between the crude protein in the wheat and strength of flour as determined by the loaf volume. There is generally even a higher, positive correlation between protein in the flour and loaf volume.

The gluten content of the flour is very closely correlated with loaf volume. The intensity of association between these two variables appears to be greater than that for protein in flour and loaf volume. There is generally a high, positive correlation between wet gluten content and loaf volume. With some exceptions, a positive, fairly high correlation is observed between water absorption of the dough and loaf volume. In normal, sound wheat apparently no significant correlation exists between flour yield and loaf volume. Excepting for a few wheat groups, a positive and sometimes very high correlation is found between gliadin content and loaf volume.

Dry gluten content is generally highly correlated with gliadin content. Contrary to expectations, the limited data for dry gluten content and water absorption reveal no significant correlation between these two variables. As indicated by the correlation ratio, loaf volume is associated more closely with gluten quality than with any other character considered. There appears to be a constant and fairly high correlation between the content and quality of gluten.

Foreign material in spring wheat, R. H. BLACK and C. R. HALLER (*U. S. Dept. Agr., Farmers' Bul. 1287 (1922), pp. 22, figs. 12*).—Foreign material in wheat is defined, its increase in spring wheat and factors responsible therefor are discussed, the objections to foreign material are pointed out, and the benefits derived from clean wheat are indicated. Representative seeds of 20 kinds of weeds and grain commonly found in spring wheat are illustrated. The injurious effects on the milling yields and baking qualities of the flour from wheat containing different amounts of corn cockle are shown graphically. Methods of cleaning wheat on the farm and at country elevators are outlined, with descriptions of cleaning machines and their functions. Tests with a recleaner for threshing machines have been noted earlier (*E. S. R.*, 47, p. 91).

Cocksfoot [orchard grass] seed, N. R. FOY (*New Zeal. Jour. Agr.*, 25 (1922), No. 3, pp. 165-167, fig. 1).—A brief account of the production of cocksfoot seed (*Dactylis glomerata*) in New Zealand is presented with notes on germination and purity.

In 1920-21, the total area in New Zealand cropped for cocksfoot seed was 17,527 acres, mostly in Canterbury Province, and averaging 155.46 lbs. per acre. The average germination at Wellington Biological Laboratory during 6 years has ranged from 55 to 66 per cent. The combined presence of Yorkshire fog, goose grass, and cut's-ear usually indicates New Zealand seed.

Spotted medick, E. W. FENTON (*Jour. Min. Agr. [London]*, 29 (1922), No. 7, pp. 643-648, figs. 2).—The characteristics of spotted medick (*Medicago arabica*) and its distribution in England are pointed out. The weed was probably introduced in wool and sheep pelts from South Africa and Australia. The fact that washings and cleanings from wool containing a varied assortment of seeds, including much spotted medick, are often put on land by farmers explains the presence and absence of the weed in localities of similar soil and situation.

Dusting with ammonium sulphate at rates of from 5 to 12 oz. to 8 sq. yds. gave the only successful results in eradication tests, with the heavier applications giving the quickest action. Treatment in early spring and fair weather is suggested for best results.

The toll of weeds in Indiana, A. A. HANSEN (*Ind. Acad. Sci. Proc.*, 1921, pp. 105-109).—Based on production during 1920, the tillage loss due to weeds is estimated to have amounted to \$11,105,450; the loss due to reduced crop yields to \$27,415,000; the discount loss caused by weed seeds in grains and seed stocks and weeds in hay to \$3,394,920; the loss due to land rendered incapable of profitable cultivation to \$100,000; the cost of clearing weeds from railroad rights of way to \$150,000; the damage by turf weeds to \$200,000; the cost of cutting roadside weeds to \$157,000; the cost of cutting pasture weeds, waste place weeds, etc., to \$1,050,000; and the miscellaneous loss to \$500,000, totaling over \$44,000,000, or approximately \$14 per capita for the year. Suggestions are offered as possible aids in the solution of this problem.

Collected leaflets on weeds (*London: Min. Agr. and Fisheries, 1922, pp. 86, figs. 26, pls. 5*).—The leaflets assembled in this weed manual give a general discussion of weeds in Great Britain and their suppression, with detailed information concerning the characteristics, habitat, and eradication methods applicable with broom rape, charlock, coltsfoot, couch or twitch grass, dodder, meadow saffron, ragwort, spurrey, common thistles, and miscellaneous common weeds.

The introduced [weed] flora of Victoria, J. R. TOVEY (*Jour. Dept. Agr. Victoria*, 19 (1921), No. 10, pp. 614-618, figs. 6).—Since 1909, 75 species of plants have been recorded as having established themselves in Victoria, some proving useful as pasture plants but the majority being troublesome weeds.

Plants not previously recorded include glaucous star thistle (*Carthamus glaucus*), Syrian thistle (*Cirsium syriacum*), *Salpiglossa rhomboidea*, and *Viola odorata*. Others showing further spread are *Claytonia perfoliata*, *Eragrostis major*, *Gnaphalium candidissimum*, *Hypericum androsaemum*, *Lactuca scariola*, *Linum gallicum*, *Nicandra physaloides*, *Ononis arvensis*, and *Oxalis purpurata*.

HORTICULTURE.

[Report of the department of horticulture of the Arizona Station], F. J. CRIDER, A. F. KINNISON, and D. W. ALBERT (*Arizona Sta. Rpt. 1921*, pp. 587-592, 593-596).—In this progress report (E. S. R., 45, p. 438) for the year ended June 30, 1921, various projects are briefly discussed without including data.

Orchard fertilization studies indicated that leguminous cover crops are more important in maintaining yield and vigor in citrus orchards than are commercial fertilizers. Sour clover (*Melilotus indica*) and common and hairy vetches were used with satisfaction when preceded by inoculation. Observations on the differences in air and soil temperatures and atmospheric humidity in two adjacent orchards, one in clean culture and the other in alfalfa, revealed lower temperatures and evaporation and higher humidity in the alfalfa-cropped orchard.

A study at the Yuma Station on the effect of irrigation during blossoming time upon the set of fruit of the olive indicated inconclusively that watering at this period is detrimental to fruit formation. Results of pruning studies with the olive substantiate those of Bioletti (E. S. R., 46, p. 140), namely, that severe pruning reduces and retards the set of fruit.

Variety tests with various fruits at the Salt River Valley farm and at the Yuma Station are briefly discussed. Of nine beet varieties, tested, Bassano and Crimson Globe were found of greatest merit.

Plant breeding at Proskau, F. HERRMANN (*Ber. Hoher. Staatl. Lehranst. Obst. u. Gartenbau Proskau, 1920-1921*, pp. 105-114, figs. 4).—This is a further report upon experimental activities (E. S. R., 46, p. 734).

Extended investigations in the transmission of heading and root characters in several forms of the genus *Brassica* showed that the root enlargement is apparently a dominant and heading apparently a recessive character. The practical absence of heading in the progeny of cultivated cabbage×wild cabbage leads the author to suggest that it is fortunate for German gardeners that the wild cabbage occurs only upon Helgoland Island. The heading character was transmitted only when both parents were of the heading type. Widely divergent crosses, for example, cabbage×white mustard, kohlrabi×field mustard, and radish×kohlrabi, produced no seeds. Kohlrabi×cabbage yielded plants showing an imperfect enlargement of the root, but of sufficient size to indicate the dominance of this character.

In a comparison of cabbage and kohlrabi transplants with those grown directly in the field, no evidence was obtained to show that transplanting had any effect on head or root development. A comparison of old and new cabbage seed showed no difference except in the percentage of viability.

Breeding studies with the tomato are reported, in which the author in crossing two divergent varieties, Courtet and Paragon, found that the segregation of characters occurred for the most part in conformity with Mendel's law. In a comparative study of the yield of F_1 tomato hybrids with those of the parent varieties, significant increases in yield and vigor were noted only in a few instances.

The inclosure of strawberry blooms in paper and gauze sacks resulted in seeds possessing respective viabilities of 28 and 49 per cent. Neither brushing

the inclosed flowers nor applying pollen from another plant of the same variety increased the viability of resulting seed, leading the author to conclude that self-pollination in the strawberry results in satisfactory seed formation.

A strain of cucumber maintained for three successive years by artificial self-pollination gradually declined in vigor and productivity, but was restored to full strength by fertilization with pollen from another plant.

Greenhouse cucumber breeding, W. J. STRONG (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 271-273).—Three varieties of cucumbers, Suttons Everyday, Fisks White Spine, and Princess, enter into the parentage of a new variety bred at the Vineland, Ontario, Horticultural Experiment Station. The fruits of the new variety average 8 to 10 in. in length and 2 in. in diameter, are dark green in color, and develop quite freely without the aid of artificial pollination.

Vegetable culture, H. C. DAVIDSON (*London: Crosby Lockwood & Son, 1922*, pp. VIII+144, figs. 51).—An alphabetically arranged English text presenting brief cultural information for all the more common vegetables.

Cyclopedia of hardy fruits, U. P. HEDRICK (*New York: Macmillan Co., 1922*, pp. VIII+370, pls. 16, figs. 325).—A comprehensive manual, illustrated in part in color, presenting historical and descriptive information pertaining to the species and varieties of hardy fruits grown in North America. The information, although drawn largely from the fruit books of the New York State Experiment Station (E. S. R., 38, p. 42), is herein condensed and presented in a less technical manner, with the purpose of extending its usefulness to fruit growers in general. The taxonomy, geographic origin, and distribution of the various species are briefly discussed.

Seed bed and nursery problems for the fruit breeder, H. L. LANTZ (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 263-267).—A general discussion relating to improved methods of handling fruit seeds in order to secure maximum germination.

Flower buds and the time of their formation, O. KRAMER (*Deut. Obstbau Ztg.*, 68 (1922), No. 33, pp. 306-308).—Studies conducted at Oppenheim, Germany, are reported, wherein the author determined the date of flower bud formation in several varieties of pear, apple, and cherry. The data, presented in tabular form, show that differentiation occurred before the end of July in all the fruits studied. Considerable variation was observed between the pear varieties, with little or none in the cherries. Flower bud formation occurred 14 days earlier in Winter Gold Pearmain than in Weisser Claräpfel, an autumn apple, indicating that time of maturity of fruit had no bearing on time of fruit bud formation.

Relation of temperature to blossoming in the apple and the peach, F. C. BRADFORD (*Missouri Sta. Research Bul.* 53 (1922), pp. 3-51, figs. 9).—A critical study of phenological and meteorological records taken at Columbia, Mo., by the Missouri Station, at Wauseon, Ohio, by the U. S. D. A. Weather Bureau, and at Pomona, Calif., by the California Experiment Station, indicated the inaccuracy as applied to the peach and apple of the hypothesis advanced by Reaumer (1735) and modified by later workers, namely, that a given summation of heat is required to bring plants to the blossoming stage.

At Wauseon the time of bloom in the Late Crawford peach was apparently hastened by exceptionally high accumulations of heat in November and December. The King apple was, on the other hand, unaffected in the same years, indicating that the two species respond differently to heat influences. The agreement in temperature accumulations to blossoming from year to year at one locality was found to vary with the length of time for which recorded.

indicating that temperature is not a consistently limiting factor. In the peach the amount of heat as measured in day degrees received from January 1 to blossoming varied with the season and with the locality. The average temperature accumulation from January 1 to blossoming in the apple was much less at Pomona than at Columbia or at Wauseon. In general, at Columbia early blossoming apple varieties were affected by ordinary temperatures earlier than were late blooming kinds.

Microscopical studies of apple buds at Columbia led to the conclusion that at least two factors, one stimulating development during the fall and the other stimulating development during winter, affect the season of blooming. Varieties blooming midseason are believed to have a mixed genetic composition in this respect. Blossoms forced in the greenhouse behaved in a manner to indicate that the time of bloom is connected with the rest period rather than with differential temperature requirements. It is thought that varietal differences in the peach at Columbia are masked and might very well appear in a more southerly location.

Pollination studies at Proskau, EWERT (*Ber. Höher. Staatl. Lehranst. Obst u. Gartenbau Proskau, 1920-1921, pp. 76-82, figs. 4*).—Observations upon several apple varieties showed that in general those varieties with long pistils produced a larger number of seed per fruit than did varieties with short pistils. The author believes that this difference is due to the greater certainty of bees and other insects pollinating the longer pistil blossoms. In referring to the pollen studies of Florin (*E. S. R., 46, p. 39*), the author points out that his own experiments have shown that the percentage of viable pollen varies in a single variety from year to year.

The relation of cross-pollination to yield was shown in a Gold Pearmain apple orchard, in which an unexpected rise in yield in one part of the orchard was found to be correlated with the unexpected presence of a tree of another variety.

Investigations of the cause of self-sterility in the Fröhste der Mark sweet cherry included a study of the reduction divisions of the pollen mother cells, in which it was found that the heterotypic and homeotypic cell division proceeded in the normal manner, and that the haploid chromosome count was eight. A viability test of the pollen in a 10 per cent sugar solution showed from 60 to 90 per cent of good grains. From these observations the author concludes that the cause of sterility in this variety does not lie in the male floral parts.

The negative influence of pinching upon size of fruit in the Calville Blanc apple, G. RIVIÈRE and G. PICHARD (*Jour. Soc. Natl. Hort. France, 4. ser., 23 (1922), June, pp. 226-228*).—A report of a test in which the average weight of the fruits was determined on three espalier-trained Calville Blanc apple trees submitted to different pruning treatments. Tree 1, in which those leaf shoots arising at the base of the fruiting spurs were pinched at the third or fourth leaf bud, bore 31 fruits, averaging 187 gm.; tree 2, in which all leaf shoots were pinched except those at the base of the spurs, bore 24 fruits, averaging 170 gm.; tree 3, receiving no treatment whatever, yielded 25 fruits, averaging 201 gm. The results, although described as preliminary, lead the authors to conclude that pinching leaf shoots has a deleterious effect on the size of fruit.

Some results of pruning investigations with peaches, M. A. BLAKE (*Amer. Soc. Hort. Sci. Proc., 18 (1921), pp. 213-222*).—In reporting further (*E. S. R., 41, p. 239*) upon peach pruning investigations conducted at Vineland by the New Jersey Experiment Stations, the author discusses the effect of different amounts of pruning upon the vegetative development and the productivity of

young peach trees. Measurements of the first and second year growth on Stump, Carman, and Elberta trees showed that not only the total length growth but also the number of branches was greatly increased in the second season.

A study of the relation of the amount of pruning to yield indicated that severe pruning of young peach trees materially retards and reduces early production of fruit. Observations upon eight unpruned Carman trees showed an average production in their third summer of 58 lbs., 8 oz., with a distinct correlation between yield and amount of growth. Yields, presented in tabular form, for Stump, Carman, and Elberta trees submitted to various pruning treatments showed a much higher production in unpruned than in pruned trees. The lowest yields and the largest sized fruits were obtained from trees cut back severely in winter. Moderate pruning, sufficient to insure proper development of the young tree, did not materially reduce the initial yield of Carman trees; while, on the other hand, severe pruning, in which 60 per cent or more of the growth was removed, did noticeably reduce production. Records of the comparative size and number of fruits on unpruned and pruned trees indicated that the number of fruits rather than the degree of pruning affected the size of the individuals. That variety is also a factor in influencing the size of fruit was seen in the Elberta, where a distinct tendency was noted for the production of large fruits on young trees. In concluding, the author points out that the results show distinctly that pruning operations on young trees, wherein 65 per cent or more of the annual growth is removed, seriously affect the production of fruit.

Vineyard plans, F. T. BLOTTI (*California Sta. Circ.* 253 (1922), pp. 12, figs. 4).—Information of a practical nature is presented relative to the various details of laying out vineyards, namely, charting of the position of the vines, roads, irrigation systems, permanent windbreaks, and inclosures.

Breeding work with blackberries and raspberries, H. NESS (*Jour. Heredity*, 12 (1921), No. 10, pp. 449-455, figs. 3).—In connection with a general review of bramble fruit breeding activities carried on at the Texas Experiment Station since 1909 (E. S. R., 43, p. 535), the author further describes a successful attempt in crossing two apparently distinct species, *Rubus rubrius* and *R. strigosus*. The F_1 plants of this interspecific cross closely resembled the *R. strigosus* parent, but were nearly sterile. Of the F_2 plants, however, five bore good crops of fruit, from which were raised a numerous F_3 population. A study of four plants selected from the F_2 generation on account of desirable characters showed an extremely protracted fruiting period, extending from the middle of May to the middle of August, the latter part of the crop being borne on shoots of the current season. The berries maintained their size and flavor throughout the entire period.

Pruning young olive trees, F. T. BLOTTI (*California Sta. Bul.* 348 (1922), pp. 87-110, figs. 8).—The material presented herein was reported in somewhat less detail in an earlier paper by the same author (E. S. R., 46, p. 140).

Of the three types of pruning compared on Mission olive trees at Davis, namely, (1) no pruning, (2) summer pruning in the first and second growing seasons, and heavy winter pruning at the end of the third and fourth growing seasons, and (3) heavy winter pruning at the end of the first, second, third, and fourth growing seasons, much the better results were obtained from no pruning. The unpruned trees not only developed a more symmetrical form but also bloomed and fruited much earlier than the pruned trees. Measurements of trunk circumference at 25 cm. (about 10 in.) above the ground, recorded at 18, 25, and 40 months after planting, showed that heavy pruning

materially decreased trunk development. Even the lightly summer pruned trees in group 2 were 13 per cent below the unpruned at the end of the first two years. In respect to height of trees at the end of 40 months, the unpruned trees were found to be more than twice as tall as those in group 2 and nearly three times those in group 3. In May of the sixth year, 61 months after planting, 5.7 per cent of the unpruned trees, 60.5 per cent of group 2, and 91.7 per cent of group 3 trees failed to blossom. On a basis of 100 for the amount of bloom on the unpruned trees, those in group 2 graded 11 and those in group 3, 4. Practical recommendations based on the results of the experiments are given in the text.

Fertilizer experiments with citrus trees, R. S. VAILE (*California Sta. Bul. 345* (1922), pp. 465-512, figs. 16).—This is a report for the period 1907-1920 on fertilizer experiments conducted at five California points, namely, Riverside, Arlington, Ontario, Chula Vista, and Naranjo.

The Riverside investigations, begun in 1907 and located on a carefully chosen site, embrace a study of 17 different fertilizer combinations on oranges and lemons. Evidence was obtained to show that nitrogen is the most essential plant food; however, when used in concentrated forms like nitrate of soda and dried blood this material was found to induce the development of mottle leaf, a condition which rendered the trees practically useless. Trees receiving no nitrogen were decidedly unproductive, even when supplied with phosphoric acid and potassium. No evidence was found to indicate that phosphoric acid and potassium when used in conjunction with nitrogen had any effect on yield. Bulky organic manures were effective in promoting yield and in limiting mottle leaf in the Valencia and Lisbon lemons. The manured plats produced 50 per cent more fruit than the dried blood or complete fertilizer plats. The addition of winter cover crops to manured plats gave better results than manure and clean culture.

The value of nitrogen in the form of manure was further emphasized in an experiment at Arlington Heights, in which several different fertilizer treatments were compared in a test of various methods of renovating a run-down citrus grove. Although chemical fertilizers were much more rapid than manure in influencing the yield of trees, at the close of five years the manured trees were not only yielding as well as those of any other group but were better colored and more vigorous. The plats mulched with alfalfa hay showed striking yield increases, but by the fifth year the trees were seriously affected with mottle leaf. The use of winter cover crops showed no particular advantage on any of the fertilizer plats, and on the manured plats the yields were distinctly less with cover crops than with clean culture. On unfertilized plats cover crops had a slightly depressing effect in the second and third years, followed by beneficial results in the fourth and fifth seasons. The best fruit was obtained on the dried blood plat. Under the conditions obtaining in the experiment, phosphoric acid and potassium were not found to be essential.

In experiments at Ontario, fertilizer and cultural tests were carried on in an orchard 16 years of age and badly neglected at the commencement of the experiment. Yields of the first year indicated that the quantity of nitrogen was much more important than the source. Mulching had more effect on yield than clean culture or cover crops with or without lime, but was, as in the other experiments, followed by mottle leaf, which became so prevalent in the fifth year as to affect production materially. The six-year average yield on the cover cropped areas of all the plats was identical with the yield of the clean cultivated areas. However, in the sulphate of ammonia plat, that portion upon which cover crops were grown was markedly superior in yield and appearance to the clean cultured section. The apparently deleterious effect

of cover crops on the complete fertilizer area is believed to be due to the lack of sufficient nitrogen for both the trees and the cover crop.

In a cooperative field fertilizer and cultural test with lemons at Chula Vista the basined and mulched trees made the greatest growth and yielded the most fruit. Unfertilized trees were decidedly inferior in color and size and came into bearing later than the fertilized. Cover crops did not show any significant effect on yield, except in one instance where they were supplemented with lime. The results of a similar test with navel oranges planted in 1907 near Naranjo were seriously disturbed by poor drainage and gopher injuries.

The different California citrus soil types are briefly discussed. In general conclusion the author points out that all the experiments have shown the value of nitrogen, and that no definite benefit has occurred from the use of potassium or phosphoric acid either when used alone or in conjunction with other materials. Limestone proved of no value except at Chula Vista. Mulching when practiced for a period of two or three years proved of value in renovating citrus orchards, but further continuation resulted in the development of serious mottle leaf conditions. Cover crops gave such conflicting results in the several tests that no general conclusions relative to their value or use were deduced. Groves which have suffered severely from the lack of fertilizers were greatly improved by the application of nitrogen, especially in the form of bulky organic materials.

All about coffee, W. H. UKERS (*New York: Tea and Coffee Trade Jour. Co.*, 1922, pp. XXIX+796, pls. 18, figs. 670).—An exhaustive monograph dealing with the history, botany, literature, manufacture, and utilization of coffee.

Almond pollination, W. P. TUFTS and G. I. PHILP (*California Sta. Bul.* 346 (1922), pp. 3-35, figs. 15).—With slight additions, this bulletin is practically identical with an earlier publication (*E. S. R.*, 41, p. 148).

The cinchona (quinin) industry in Java, W. N. SANDS (*Malayan Agr. Jour.*, 10 (1922), No. 3, pp. 65-86).—A general account dealing with the production of quinin.

London trees, A. D. WEBSTER (*London: Swarthmore Press*, 1920, pp. XII+218, pls. 32).—An illustrated manual on tree species which succeed in London, England.

Willow culture, E. LEBOUX (*Osiéiculture: Culture de l'Osier et Vanneries d'Osier. Paris: J. B. Baillière & Sons*, 1921, pp. XII+352, figs. 183).—A general account dealing with species of willows suitable for basket making, with notes on their culture, protection from insects and other enemies, and the manufacture of baskets and various other articles.

Features of the flora of Mount Rainier National Park, J. B. FLEET ([*U. S.*] *Dept. Int., Natl. Park Serv.*, 1922, pp. 50, figs. 40).—A circular of general information which, through the media of discussion and remarkably clear illustrations, imparts information concerning the floral beauty of the park.

The culture of pot plants in rooms, greenhouses, and frames, H. C. DAVIDSON (*London: Crosby Lockwood & Son*, 1922, pp. VII+154, figs. 63).—A small English text presenting information relative to the culture of glass-house and other protected plants.

FORESTRY.

Forestry and our land problem, H. C. WALLACE (*Amer. Forestry*, 29 (1923), No. 349, pp. 14-18, figs. 6).—A constructive article emphasizing the seriousness of the forestry situation in the United States, and pointing out the importance of lumber in our national life and the need of intelligent

utilization of the vast areas of cut-over lands which are now idle and which are for the most part adapted primarily to the growing of forest crops. The extension of the national forest program is urged to include areas in all the timber-producing States.

Development of cooperative shelter-belt demonstrations on the northern Great Plains. R. WILSON and F. E. COBB (*U. S. Dept. Agr. Bul. 1113* (1923), pp. 28, figs. 15).—Demonstration shelter-belt plantings on the northern Great Plains area, a region characterized by low annual rainfall, high summer and extremely low winter temperatures, and frequent strong winds throughout the year, have shown that, with proper selection of species, adequate preparation of the soil, and good care during early life, plantations can be successfully established. A study of a considerable number of species indicated that box elder, green ash, white elm, and caragana were particularly well adapted to this area. Other species, the northwest poplar, chokecherry, buffalo berry, Russian olive, Black Hills, white, and blue spruces, and Scotch and jack pines, gave promise of adaptability.

For the conservation of moisture and destruction of weeds it is recommended that clean summer fallowing precede actual planting. Clean culture was found to be essential during the young life of the plantations. Seed procured from native trees yielded hardier seedlings than that imported from southern and eastern localities.

Measurements taken in 1920 of the height growth of trees in 349 plantations distributed over four States showed an average of 6.7 ft. for box elder and 4 ft. for caragana trees planted in 1916. Norway or Carolina poplar made the greatest height growth, but was continually killed back by freezing. Spacing experiments, though incomplete, indicate that the distance, 4 by 8 ft., commonly used in the demonstrations, is too close.

The shelter belt as an asset on the Iowa farm. I. T. BODE (*Iowa Agr. Col. Ext. Bul. 108* (1922), pp. 16, figs. 10).—A general account dealing with the establishment of nursery belts in the open prairie regions of Iowa and presenting information relative to desirable nursery stock, methods of planting, planting plans, plant materials, etc.

Studies in forest tree seeds: Seed storage and chemical treatment. E. N. MUNNS (*Jour. Forestry*, 20 (1922), No. 3, pp. 316, 317).—Following treatment with several different fungicidal materials, namely, formaldehyde, hydrochloric and sulphuric acids, copper sulphate, and steam, western yellow pine seeds were stored in small bottles from 1915 until 1921 and then tested for germination. With the exception of the steamed lot, all the seeds showed a marked increase in germination as compared with check lot, leading the author to conclude that fungi or microorganisms of some nature have a very important relation to successful seed storage, exerting, perhaps, an influence equal to if not greater than that of the method of storing.

A new hybrid pine (*Pinus palustris* × *P. taeda*). H. H. CHAPMAN (*Jour. Forestry*, 20 (1922), No. 7, pp. 729-734, pl. 1).—A natural hybrid form of pine, *P. palustris* × *P. taeda*, found at several different points in Louisiana is deemed of promise on account of containing desirable characters of both parents, namely, the resistance to fire and oleoresin content of the longleaf pine and the rapid growth of the loblolly pine. Furthermore, it is believed that the hybrid will be less attractive to hogs than are the seedlings of the longleaf pine. It is suggested that the hybrid, if capable of producing fertile seed, should be propagated.

Forestry among the giants. W. METCALF (*Amer. Forestry*, 28 (1922), No. 347, pp. 643-654, figs. 11).—A comprehensive and well illustrated article dealing with *Sequoia sempervirens*, the coast redwood of California.

Emphasis is placed on the rapid growth of the species in early life, the remarkable yields of well stocked stands, and the ability of the species to reproduce abundantly from root sprouts. The scarcity of natural seedlings is believed to be due in part to the fact that the seed of old trees has very poor viability. Studies in reproduction indicated that with proper control of fires on cut-over lands fair natural restocking will take place. It was found that seedlings could be produced satisfactorily in the forest nursery. From an economic viewpoint it is estimated that not over 10 per cent of the redwood lands will ever be adapted to agriculture, and it is urged that the remainder be utilized in the permanent production of this valuable timber.

Preliminary results with exotic forest trees at Mont Alto, Pa., J. S. PERRY (*Jour. Forestry*, 20 (1922), No. 7, pp. 735-744).—Describing as exotic all trees which are not native to Pennsylvania, the author presents information on the behavior of 28 such species in the forests nurseries at Mont Alto. Many of the introduced trees were unable to survive the weather conditions.

DISEASES OF PLANTS.

Plant pathology, J. G. BROWN (*Arizona Sta. Rpt. 1921*, pp. 606-615, figs. 4).—A brief account is given of date rot, which has been previously reported upon (*E. S. R.*, 44, p. 346). In connection with this disease the author reports having isolated from diseased leaves and fruits several organisms, and among them species of *Macrosporium*, *Alternaria*, and *Helminthosporium* have been shown by inoculations to be actively parasitic on the unripe fruit. In addition to these, species of *Aspergillus*, *Penicillium*, *Sterigmatocystis*, and a bacterium have been isolated from diseased leaves. All of the organisms are being studied in some detail, and attempts are being made to determine the relative susceptibility of varieties as well as means for control. Preliminary experiments have indicated that spraying with a 4-4-40 Bordeaux mixture protected the fruit from rotting.

Attention is called to the cotton black arm and angular leaf spot diseases which are due to *Bacterium malvacearum*. The causal organism is borne by the seed, and it is suggested that this could be treated with sulphuric acid to secure control. This disease seems to be most prevalent in fields of Pima Egyptian cotton. Experiments are in progress to determine whether there is any direct relation between the occurrence of alkali in the soil and susceptibility to disease.

An outbreak of bacterial rot of lettuce was reported as having taken place in the spring of 1921, and laboratory studies have shown the presence of two bacteria which are capable of rotting healthy heads of lettuce. Studies are said to be in progress to determine the identity of bacteria and the source of infection.

Notes are given of diseases observed on a number of economic plants. Among them, attention is called to a grape rot, the cause of which is unknown. When attacked by this disease, the unripe fruits of white varieties become spotted with soft, brownish, semitranslucent areas. Later the fruit shrivels and rotting begins, the spots becoming bronzed, later turning to purple.

Report of the Dominion Field Laboratory of Plant Pathology, St. Catharines, Ont., W. H. RANKIN (*Canada Expt. Farms, Div. Bot. Interim Rpt., 1921*, pp. 67-93, fig. 1).—As regards the experiment on control by surgery of peach canker, it is thought safe to state that the disease spreads easily in the growing season, newly diseased trees showing slight symptoms in late autumn and severe attack the following spring. The eradication of diseased trees is

recommended until better methods of control are known, and the removal should be accomplished as early in the season as possible.

Studies on the nature of susceptibility are outlined. The plant disease survey gave as a main result a modification of the plan which is indicated. Miscellaneous reports deal with spraying and dusting trials with various fruits, leaf curl or yellows of red raspberries, the seasonal history of brown rot of stone fruits, white pine blister rust, mosaic and leaf roll of potato, extension activities, lightning injury of field-grown tomatoes, and studies in electroculture.

Report of the Saskatoon Laboratory of Plant Pathology in cooperation with the University of Saskatchewan, and the Dominion laboratory at Indian Head, for 1920-21, W. P. FRASER (Canada Expt. Farms, Div. Bot. Interim Rpt., 1921, pp. 93-108).—No systematic survey of plant diseases was carried out in western Canada during the year, but many field observations were made, and the most important of these are here recorded, including those on wheat, rye, barley, oats, flax, sunflower, pea, bean, potato, black currant, aster, rhubarb, western rye grass, awnless brome grass, and timothy.

Experimentation to determine the effect of stem rust on different varieties of wheat and emmer and also to determine the biologic forms that will develop under varying conditions was carried out cooperatively, and the results are tabulated with discussion.

The western rye smut investigation experiments show, as did those carried on in 1918-19, that the smut is readily controlled by the ordinary formalin treatment. No injury to the seed was evident. These experiments also show that the spores remain viable for at least one year. Smut studies in the laboratory showed spores to germinate readily in sugar solution, sporidia being developed in abundance, indicating that this smut belongs to the seedling infection group. The smut belongs under *Ustilago* and is closely related to *U. bromivora*. The species has been tentatively named *U. agropyri*.

As regards studies on the overwintering of the uredospores of stem rust of wheat the results confirm the experiments of previous years, indicating that the uredospores may overwinter on grasses. No field evidence, however, was obtained to show that spring infection comes from this source.

The first spring appearance of stem rust was investigated, and data are recorded for 10 places. Rust first appeared on barberries and was collected next on grasses in the vicinity. The next collections were on wheat, and the rust seemed to spread from wheat to grasses. No evidence was obtained that the rust wintered on grasses and spread to wheat.

Experiments to determine the distribution, time of appearance, and nature of the strains of wheat rust present begun in January, 1920, showed clearly that strain XVII (Stakman) was much more common and widely distributed in 1919 and 1920 than the other strains. It was also present in greater abundance and appeared earlier in the season. In 1919 strain IX was much more abundant at Saskatoon than in 1920, White spring emmer in the field being heavily rusted.

Regarding stripe disease of barley, experiments were carried on to determine the best means of control for *Helminthosporium gramineum*, badly diseased seed of three varieties being used. It appears from the result that soaking the seed in formalin for two hours gives the most satisfactory control of the disease. No injury to germination was apparent, though no tests were made.

The barberry and buckthorn survey has established that not many barberries or buckthorn have been planted in the western part of Canada except in some of

the larger cities. The barberry survey in Manitoba in 1920 showed that the buckthorn, like the barberry, is mostly confined to Winnipeg, where it is abundant. The buckthorn was frequently rusted, especially in the parks.

Brief notes are given by J. Adams on economic and systematic botany.

Anaerobic bacteria in plant tissues, J. DUFRENOY (*Phytopathology*, 11 (1921), No. 8, p. 344).—The occurrence of anaerobic bacteria in tumors on *Picea excelsa* and in diseased roots of *Juglans regia* is reported, and attention is called to the fact that in studying many diseases parallel cultures under aerobic and anaerobic conditions should be made.

Internal aecia of Puccinia albiperidia, M. W. TAYLOR (*Phytopathology*, 11 (1921), No. 8, pp. 343, 344, fig. 1).—The occurrence of internal aecia of *P. albiperidia* in mummified fruit of *Ribes glandulosa* is reported.

The pathology of Lupinus arboreus, with special reference to the decays caused by two wound parasites, *Collybia velutipes* and *Pleurotus ostreatus*, A. S. RHODES (*Phytopathology*, 11 (1921), No. 10, pp. 389-404, pls. 3).—The occurrence is reported of *C. velutipes* and *P. ostreatus*, both as wound parasites and saprophytes, on dead stems of *L. arboreus*, an arborescent shrub growing in sand dunes near San Francisco. Infection is commonly through insect tunnels, split crotches, and dead twigs. The author recommends the planting of *L. chamissoni* for a sand dune cover instead of *L. arboreus*, as the former species is not subject to attack of the boring insects.

Sunburn and aphid injury of soy beans and cowpeas, F. GIBSON (*Arizona Sta. Tech. Bul.* 2 (1922), pp. 41-46, pls. 2, fig. 1).—A study is reported of sunburn and aphid injury of soy beans and cowpeas, the attention of the author having been called to the injury in the fall of 1920. In 1921 plats were planted with several varieties of soy beans and cowpeas, and investigations were carried on during the growing season. The first indication of disease is said to be the appearance of small brick-red spots on the upper surface of the leaves, usually within the veins. Later the size of the spots increases, and a fungus growth is observed. Similar spots have been noted on pods of some varieties of soy beans, but not on pods of cowpeas. As a result of inoculation experiments, it was found that the primary cause of the disease is the sunburning of the leaves or aphid injury, the fungus infection being secondary. The fungus, which was isolated and studied at length, is technically described as *Alternaria atrans* n. sp.

Wilting caused by walnut trees, M. T. COOK (*Phytopathology*, 11 (1921), No. 8, p. 346).—Attention is called to numerous cases of wilting of potato and tomato plants grown in the immediate vicinity of walnut trees. Other crops did not seem to be affected in this way, nor did other trees cause wilting of the crops.

The mycoplasma theory: Is it dispensable or not? J. ERIKSSON (*Phytopathology*, 11 (1921), No. 10, pp. 385-388).—A brief review is given of work by Pritchard (E. S. R., 26, p. 143), Beauverie (E. S. R., 32, p. 642), and Hungerford (E. S. R., 37, p. 751), in which evidence of sori of rusts within the seed coats of grains is claimed. The author holds that the occurrence of such bodies does not disprove his theory, and he offers additional data from studies of *Phytophthora infestans* on potato and *Peronospora spinaciae* on spinach to confirm his previous claims. A number of other fungi are mentioned, in which the author believes mycoplasma symbiosis is a part of their life cycle.

Resistance of barley to Helminthosporium sativum, H. K. HAYES and E. C. STARKMAN (*Phytopathology*, 11 (1921), No. 10, pp. 405-411).—In connection with experiments on the production of a smooth-awned barley, the question of resistance to *H. sativum* was considered. In the first group of crosses pro-

duced all were found susceptible to the fungus, and, in addition, they had undesirable agronomic characters. Later crosses that have been carried through the F_2 generations were found desirable from the standpoint of yield and quality, and the plants were quite resistant to the attack of this fungus. As a result of this experiment, the authors believe that resistant varieties of any botanical group of *Hordeum* can be produced.

The dusting of wheat for bunt or stinking smut, F. D. HEALD and L. J. SMITH (*Washington Col. Sta. Bul. 171 (1922), pp. 3-28, figs. 5*).—This publication is a revised edition of Bulletin 168 of the station (*E. S. R.*, 47, p. 648) and includes additional data derived from experiments on smut control carried on in 1922. The efficiency of copper carbonate was again confirmed, artificial smutting having been resorted to. Tests were made of a number of proprietary compounds, among them one containing copper carbonate and another an organic mercury compound. The proprietary compound gave better protection than pure copper carbonate carrying the same amount of copper. The mercury compound did not give as good control as the copper compounds. Field trials are reported with winter wheat in which the relative efficiency of sulphur, copper sulphate, copper carbonate, and formaldehyde were compared, and while there was some variation in the results, in general copper carbonate gave the best average control.

A dry-rot disease of alfalfa roots caused by a *Fusarium*, W. P. COTTAM (*Phytopathology*, 11 (1921), No. 9, p. 383).—A root disease of alfalfa, which is said to be of considerable importance in southern Utah and possibly also in Arizona, is attributed to a species of *Fusarium*.

Black arm of cotton: A successful method of control, J. G. BROWN (*Arizona Sta. Timely Hints for Farmers*, No. 142 (1922), pp. 8, figs. 4).—Directions are given for the treatment of cottonseed with sulphuric acid for the control of bacterial diseases of cotton caused by *Bacterium malvacearum*.

Investigations of heat canker of flax, C. S. REDDY and W. E. BRENTZEL (*U. S. Dept. Agr. Bul. 1120 (1922), pp. 18, pls. 5, figs. 4*).—The results are given of cooperative investigations with the North Dakota Experiment Station on a nonparasitic disease of flax which at times has caused considerable loss in production. When attacked by this disease the cortex of the stem is killed at the surface of the ground, and sooner or later the cankered plants fall over. In the experiments reported, flax was cankered only during and immediately following very hot days and usually when the plants were less than 4 in. high. Evidence was obtained that indicates that heat canker of flax results from a combination of succulence in the young flax plants and high temperatures of the surface soil in immediate contact with the stems. It is believed that thicker seeding and early sowing, possibly running the drills north and south, would lessen the liability to injury.

Lanas [disease of potato] and its control, III, H. JENSEN (*Proefsta. Vorstenland, Tabak [Dutch East Indies], Meded. 38 [1919], pp. 35-53*).—The two earlier numbers of this series have been noted (*E. S. R.*, 39, p. 149). In the present contribution, the author deals chiefly with means of infection, including village manures and running water as spore carriers and with measures looking to control, including fungicidal treatment of manures.

Parasitism of *Sclerotium rolfsii* on Irish potatoes, H. A. EDSON and M. SHAPOVALOV (*Jour. Agr. Research [U. S.]*, 23 (1923), No. 1, pp. 41-46, pls. 3).—On account of a lack of definite information regarding the type of decay on the potato and the mode of destruction of the host cells by *S. rolfsii*, the authors have conducted an investigation of the subject, and have given the results of their studies of natural and artificial infections with the organism.

It is claimed that infection of the Irish potato plant with *S. rolfii* may manifest itself in a variety of symptoms which may be grouped according to their appearance as seed-piece rot, damping off, stem rot, wilt, and blight.

Infection of the potato tuber results in a progressive soft white rot, which may take on the so-called melter form with profuse extrusion of liquid.

The destruction of the host tissues may be accomplished without hyphal penetration by means of digestive enzymes.

Existence of varietal strains in the fungus is evident from the authors' investigations.

A Phytophthora foot rot of rhubarb, G. H. GODFREY (*Jour. Agr. Research [U. S.]*, 23 (1923), No. 1, pp. 1-26, pls. 12, figs. 3).—A description is given of a disease of rhubarb caused by *P. parasitica rhei* n. var. The organism is said to be quite distinct from that recently described by Beach (*E. S. R.*, 48, p. 48). The disease is said to be primarily a foot rot and root rot, and it results in rapid and complete destruction of the plants. Prolonged warm, wet weather is said to be requisite for the development of this disease. The distribution of the disease has not yet been definitely determined, but it is known to occur in Maryland, Virginia, and the District of Columbia. Limited control experiments have indicated that spraying with Bordeaux mixture combined with sanitary measures would offer practical means of control.

Seed transmission of soy bean bacterial blight, J. B. KENDRICK and M. W. GARDNER (*Phytopathology*, 11 (1921), No. 8, pp. 340-342, pl. 1).—As a result of considerable investigation, the authors have found that the bacterial blight of soy bean is transmitted with the seed from diseased pods. In studying the organism, it was found that it closely resembled *Bacterium glycineum*, which is by some authors considered identical with *B. sojae*.

Notes on Phoma insidiosa found on Sudan grass, C. RUMBOLD and E. K. TISDALE (*Phytopathology*, 11 (1921), No. 8, p. 345).—The occurrence of the above fungus on the leaves of Sudan grass grown on the Arlington Experimental Farm, near Washington, D. C., is reported.

Minimum incubation periods of causative agent of curly leaf in beet leafhopper and sugar beet, H. H. P. SEVERIN (*Phytopathology*, 11 (1921), No. 10, pp. 424-429, figs. 4).—The author claims that a study of more than 20,000 beets grown from seed failed to show a single case of curly leaf, indicating that the disease is not carried by the seed. The relation of the beet leafhopper to this disease has been repeatedly demonstrated, and there is said to be no evidence to show that the beet leafhopper acts as a mechanical carrier of the cause of curly top. Experiments were carried on to determine the minimum time required by the leafhopper when fed on infested beet leaves to incubate the cause of the disease. The minimum incubation period of the causative agent was found to be 4 hours at temperatures between 103 and 94° F., with a mean of 100°, and 5 days at temperatures ranging from 93.6 to 53.3°, with a mean of 72.8°.

Mosaic disease of sugar beets, W. W. ROBBINS (*Phytopathology*, 11 (1921), No. 9, pp. 349-365, figs. 8; *abs. in Phytopathology*, 11 (1921), No. 1, p. 48).—According to the author, mosaic disease of sugar beets has become prevalent in both steckling and seed beet fields in northern Colorado and western Nebraska, and it also occurs in a number of commercial beet fields. This disease, which is said to be quite distinct from curly top, is characterized by the mottling of the leaves which may or may not be associated with malformation. The cause of mosaic is said to be carried by aphids, and under greenhouse conditions the incubation period on seed beets was about 24 days and on seedling plants from 12 to 18 days. No evidence was found indicating that the disease was transmitted through the seed.

A note relative to the recent appearance of the sugar cane downy mildew in the Philippines. W. H. WESTON, JR. (*Phytopathology*, 11 (1921), No. 9, pp. 371-375).—The occurrence of *Sclerospora sacchari* on sugar cane in the Philippines is reported, the infection apparently having been introduced on cane cuttings imported from Taiwan (Formosa).

Tobacco diseases in the Vorstenlanden. H. JENSEN (*Proefsta. Vorstenland. Tabak* [Dutch East Indies], Meded. 40 (1920), pp. 171, pls. 59, figs. 36).—Tobacco diseases in the Vorstenlanden (Soerakarta and Jogjakarta) are treated in systematic detail. This treatment is followed by an account of animal pests of tobacco, including nematodes.

Studies on tobacco mosaic. H. JENSEN (*Proefsta. Vorstenland. Tabak* [Dutch East Indies], Meded. 33 (1918), pp. 57-66, pl. 1).—From studies indicated it appears that recovery of tobacco plants from mosaic may extend so far that the younger leaves do not show the disease, which may also cease to be noticeable in some of the older leaves. The plant as a whole, however, retains the disease.

Tobacco resistant to *Phytophthora nicotianae*. A. D'ANGREMOND (*Proefsta. Vorstenland. Tabak* [Dutch East Indies], Meded. 37 (1919), pp. 29, pl. 1).—Tobacco in the Vorstenlanden is severely attacked at all developmental stages by *P. nicotianae*, causing the disease known as lanas. Certain varieties which are indicated are not affected, and further attempts at segregation of resistant varieties are recorded. The same distinction is drawn by the author, as previously by Jensen (E. S. R., 37, p. 553), between lanas and the disease known as lier, which is said to be caused by *Bacterium solanacearum*. Young plants on the beds can be effectively protected by spraying with Bordeaux mixture.

Control of *Phytophthora nicotianae* in the Vorstenlanden. A. D'ANGREMOND (*Proefsta. Vorstenland. Tabak* [Dutch East Indies], Meded. 39, pp. 59, pls. 3, figs. 4).—Referring to the contribution by Jensen and to that by himself above noted, the author gives an account, with English summary, of studies and experimentation looking to the control of the tobacco disease known as lanas and caused by *P. nicotianae*. The control measures include avoidance of dessamist (a compost fertilizer from the dessas or villages), the removal and destruction of all affected plants, and the use of Bordeaux mixture on the tobacco beds.

The false mildew of tobacco introduced into the United States from the Dutch East Indies? B. T. PALM (*Phytopathology*, 11 (1921), No. 10, pp. 430-432).—The author thinks that the evidence produced (E. S. R., 45, p. 247) indicating that *Peronospora hyoscyami* could have been introduced into the United States on tobacco mats from the Dutch East Indies is very slight.

Sand drown, a chlorosis of tobacco due to magnesium deficiency, and the relation of sulphates and chlorids of potassium to the disease. W. W. GARNER, J. E. McMURTREY, C. W. BACON, and E. G. MOSS (*Jour. Agr. Research* [U. S.], 23 (1923), No. 1, pp. 27-40, pls. 7).—The results are given of cooperative investigations carried on by the Office of Tobacco Investigations, U. S. D. A., and the North Carolina Experiment Station on a disease of tobacco characterized as a type of chlorosis in which the green and yellow pigments of the chlorophyll are affected. In extreme cases the color of the tissues may become almost pure white. The disease is said to be scarcely less evident in the cured leaves than in the green leaves in the field.

The investigations have shown that the disease is due to magnesium deficiency and is markedly aggravated by an increased sulphur supply. 'On this account the use of potash salts of high purity and, especially, pure forms of potassium sulphate have resulted in serious damage to the crop. The need

for magnesium can be readily met by the use of sulphate of potash containing magnesia or by applying lime containing magnesia. In view of the investigations in this disease, the authors suggest that in interpreting fertilizer action the sulphur, magnesium, and calcium commonly contained in complete commercial fertilizers should be taken into account as well as the usual elements.

In connection with this investigation, the authors describe a new method of conducting pot cultures in the study of fertilizer problems.

Leaf curling in tomatoes, H. T. GÜSSOW (*Phytopathology*, 11 (1921), No. 9, pp. 380-383, fig. 1).—Attention is called to the curling of the leaves of tomato plants grown as single stems and tied to stakes or other supports. This is attributed to increased root pressure, and it is believed that if the plants were pruned to two or three shoots the difficulty would be obviated.

Sunburn and tomato fruit rots, M. T. COOK (*Phytopathology*, 11 (1921), No. 9, pp. 379, 380, figs. 3).—Attention is called to the occurrence of sunburn on tomato fruits that are more or less exposed to the sun, especially when the vines have been defoliated by *Septoria lycopersici* or other causes. From the sunburnt areas, cultures of *Alternaria* have been made quite regularly. It is believed that the sunburnt fruits are more susceptible to fungus injuries than the normal ripe fruits, and that the fungus gains entrance through wounds, causing the fruit to rot, often with great loss.

Sclerotium rolfsii on velvet beans, W. W. GILBERT (*Phytopathology*, 11 (1921), No. 9, p. 378, fig. 1).—A brief description is given of the characteristic symptoms produced by *S. rolfsii* on velvet beans grown in southeastern Georgia.

Observations on winter injury, I, II (*Missouri Sta. Research Bul.* 56 (1922), pp. 3-26, figs. 27).—Two papers are included.

I. *Early and late winter injury*, F. C. BRADFORD (pp. 3-16).—Attention is called to the winterkilling of flower buds of the peach without injury to other parts of the tree, while on the apple in central Missouri injury is more common to other tissues and not to flower buds. Extended studies of apple trees, raspberries, and other plants showed that the direct cause of injury was due to the immaturity of the tissues at the beginning of winter. It is claimed that many plants with low optimum growing temperatures have, in central Missouri, two distinct growing seasons separated by a hot, dry midsummer. The raspberry apparently belongs to this group. Other plants with higher optima grow rather uniformly throughout the season. In this group is the peach. Sod culture is believed to accentuate the duality of the growing season for plants with a low optimum. Consequently its effect on maturity is directly opposite that recognized in regions with short and relatively cool growing seasons. The effect of tillage on the maturity of the apple is not sufficiently known. The Kieffer pear was found to be more tender in the wood in the spring than the Jonathan apple, but more hardy in its fruit buds in the fall.

Notes are given on the occurrence of second bloom in fruit trees, and it is claimed that this is not necessarily a consequence of the destruction of the first or normal bloom.

II. *An aftermath of winter injury*, H. A. CARDINELL (pp. 17-26).—The results are given of a study of the failure of trees to heal after winter injury. Where young trees have been winter injured, it is recommended that they be cut back to the point of injury and regrafted if necessary.

Winter injury of fruit in Missouri, F. C. BRADFORD (*Missouri Sta. Circ.* 107 (1922), pp. 7).—Popular descriptions are given of various forms of winter

injury induced by immaturity of tissues or premature starting from a state of dormancy.

Bitter pit in apples and pears: The latest results in preventive measures, D. McALPINE (*Phytopathology*, 11 (1921), No. 9, pp. 366-370).—The author summarizes the results of his five years' investigations on the cause and methods for the prevention of bitter pit as it occurs in Australia. The more detailed accounts of his investigations have been previously noted (E. S. R., 33, p. 352).

The brown corpuscles of grape brunissure, J. POLITIS (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 14, pp. 870-873).—Studies outlined are claimed to show that the brown bodies present in the cells are neither of parasitic origin nor of excretory character, but that they are simply the results of transformation of granular mitochondria.

The nontoxicity of copper for downy mildew, MR. and MRS. G. VILLEDIEU (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 6, pp. 335, 336).—In a continuation of reports previously noted (E. S. R., 45, p. 49), it is claimed that as a consequence of the action of lime on copper sulphate in solutions basic sulphates of copper are formed which give (as does also copper hydrocarbonate) very dilute solutions with rain water. The authors have been able to demonstrate survival and development of mildew spores in acid solutions of such salts at concentrations supposed to be present under natural conditions.

Citrus canker in the Hawaiian Islands, H. L. LYON and H. A. LEE (*Phytopathology*, 11 (1921), No. 9, p. 377).—The presence of a bacterial canker of citrus trees is reported on the islands of Oahu and Kauai.

Diseases of coconut palms in Grenada, W. NOWELL (*Agr. News [Barbados]*, 17 (1918), Nos. 434, pp. 398, 399; 435, p. 414).—An account is given of observations and studies on a disease of coconut palms in Grenada, supposedly due to the condition of the roots, which is described. The trouble appears to be the same as a coconut root disease said to prevail in Trinidad and Tobago, and is suspected to be due to nematodes.

The little leaf disease occurring sporadically, apparently due to a fungus or a bacterium, is thought to bear no relation to bud rot. Recovery was noted in several cases.

A condition ascribed to debility consequent upon poor drainage is described.

Violet root rot (*Rhizoctonia crocorum*) in the United States, J. A. FARIS (*Phytopathology*, 11 (1921), No. 10, pp. 412-423).—The results are given of a study of the root rot due to *R. crocorum*, special attention being devoted to its occurrence on the potato. This root rot, although of minor importance at present in a number of potato-growing districts of Nebraska, may become serious at any time. It is claimed that it may be easily introduced into new localities on infected tubers. Liming the soil gave no appreciable benefit.

The author points out the desirability of carefully controlled experiments with similar diseases of alfalfa, sugar beets, etc., to establish the identity of this organism.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

The destruction of wolves, C. M. LAIDLAW (*Ontario Dept. Agr., Monteith Demon. Farm Spec. Ctrc.*, May, 1922, pp. 8, figs. 4).—The habits of wolves are described, with special reference to the methods employed in trapping and destroying them.

The names of birds found in France, A. MENEGAUX and J. RAPINE (*Les Noms des Oiseaux Trouvés en France*. Paris: Rev. Française d'Ornithologie,

[1921], pp. 68).—In this small book the author gives the Latin, French, English, Italian, and German names of birds that occur in France.

[Report of the Arizona Station entomologist], C. T. VORHIES (*Arizona Sta. Rpt. 1921*, pp. 583-586).—Brief reference is made to the several projects under investigation, including work with (1) the Arizona pink bollworm, a native species which exists on the Arizona wild cotton, (2) *Hydomyia cilicrura* Rdl., a dipteran the larva of which was responsible for the failure of seed wheat to germinate, and (3) bees.

It was found that nine colonies of bees produced 968 lbs. of extracted honey and 127 sections of comb honey during the season of 1920. The maximum production was 170 lbs. of extracted honey in one colony, and 112 lbs. of extracted and 55 sections of comb honey for another colony, both being located at the University Farm.

The insect and other invertebrate fauna of arable land at Rothamsted, H. M. MORRIS (*Ann. Appl. Biol.*, 9 (1922), No. 3-4, pp. 282-305, figs. 7).—This is a report of investigations of the presence of insects and other invertebrates in two plats at the Rothamsted Experimental Farm, one of which had received annually 14 tons of barnyard manure to the acre since 1843, and the other no barnyard manure or fertilizer of any kind since 1839. It was found that there were, in round numbers, in the manured plat 15,100,000 invertebrates per acre, of which 7,720,000 per acre were insects, and in the other plat 4,950,000 invertebrates per acre, of which 2,470,000 per acre were insects.

[Report on the occurrence of insect pests on plants in England and Wales for the year 1919] (*Min. Agr. and Fisheries [London], Misc. Pub. 33 (1921)*, pp. 6-25).—Data on the occurrence of, and injury from, insects are presented in tabular form.

Insect parasites in British Guiana, J. CRABTREE (*Sugar [New York]*, 25 (1923), No. 1, pp. 37, 38).—This is an account of methods of control on sugar plantations which prove successful when properly employed.

Nicotin dust for control of truck crop insects, R. E. CAMPBELL (*U. S. Dept. Agr., Farmers' Bul. 1282 (1922)*, pp. 24, figs. 14).—This is a summary of information on nicotin dust, the manner of preparation, its effectiveness against truck crop insects, and directions for application. The different types of dusting machinery are described, and the work for which they are best adapted is indicated. Directions are given for the use of the dust in combating onion thrips, cucumber beetles (*Diabrotica* spp.), the cabbage aphid, melon aphid, and pea aphid, (*Macrosiphum*) *Illinoia pisi* Kalt.

Another camphor thrips, J. R. WATSON (*Fla. Ent.*, 6 (1922), No. 1, pp. 6, 7).—A thrips from camphor infested with camphor scale (*Pseudaulonidia duplex*) at New Orleans, La., is described as representing a new genus and species under the name *Karnyia weigeli*.

Notes on the Aeolothripidae, R. C. TREHERNE (*Ent. Soc. Brit. Columbia Proc., System. Ser.*, No. 16 (1920), pp. 7-15).—In this paper the author presents notes on the life history and habits of certain genera and species of Aeolothripidae, and a synonymic catalogue of many of the genera and species.

Green soldier bug as peach pest, W. W. JONES (*Better Fruit*, 17 (1922), No. 6, p. 9, fig. 1).—*Nezara hilaris* Say has become a serious pest in some peach orchards in Utah during the past two seasons. The pest appears to have ruined two crops of one large orchard in Davis County during the past four years.

The Australian apple leafhopper (*Typhlocyba australis* Frogg.), J. G. MYERS (*Ann. Soc. N. S. Wales Proc.*, 46 (1921), pt. 4, pp. 473, 474, figs. 4).—This is a brief account of *T. australis*, first described by Froggatt in 1918, who

placed it in the genus *Empoasca* (E. S. R., 40, p. 261). The injury to the apple by this species is said to be quite similar to that of its near relative *T. rosae* L., the apple leaves becoming variegated with yellow spots which spread to form irregular patches, giving the whole leaf a discolored appearance and eventually killing it. In contradistinction to *Empoasca*, this species shows no preference for young leaves and shoots but rather for old foliage. *T. australis* has been introduced into New Zealand, where it does considerable damage to apple trees in the orchard districts of Auckland, North Island, and of Nelson, South Island.

Natural control of the citrus mealybug in Florida, A. T. SPEARE (*U. S. Dept. Agr. Bul. 1117* (1922), pp. 19, pl. 1, figs. 2).—It is pointed out by the author that, while in California the citrus mealybug is one of the most serious enemies of citrus, in Florida it is considered of secondary importance. The object of this paper is to show why in Florida it is usually unimportant, and to call attention to the fact that a knowledge of its natural enemies is of direct economic value to the citrus grower. After first discussing citrus conditions in Florida, the author deals with insect enemies of the mealybug and insects associated with the mealybugs which are sometimes considered beneficial.

During the summers of 1920 and 1921 three insects were found associated with mealybugs, namely, *Pyroderces rileyi* Wlsm., *Laetilia coccidivora* Comst., and a species of *Chrysoplatycerus*. The larvae of the first of these, the tineid moth *P. rileyi*, known as the pink cornworm or scavenger bollworm, is conspicuous in mealybug clusters, occurring abundantly between clustering grapefruit, particularly if dead leaves are pinioned in the cluster. It appears, however, that this lepidopteran is without doubt a scavenger, playing no economic rôle so far as the mealybug is concerned. The second of these insects, the pyralid moth *L. coccidivora*, is much less common than *P. rileyi*, but like it occurs in the larval stage associated with the mealybugs. This larva forms a silken web, beneath which it lives and feeds. While no experiments were performed with this species, it is said to be looked upon generally as predacious in habit, feeding upon the mealybugs. The third insect, which is apparently new in Florida, is a chalcid of the genus *Chrysoplatycerus*. A similar species, *C. splendens* How. is reported as having been removed from mealybugs in California, and it is supposed to be a secondary parasite.

The author next describes and deals at length with the fungus parasite *Entomophthora fumosa*, a new species that is the chief factor in the natural control of the citrus mealybug in Florida. This fungus was first found in Orlando, but has later been discovered in various regions of the State, extending from Clearwater to Fort Pierce, and there is every reason to believe that it is distributed generally throughout the citrus belt. A somewhat similar form was described by the author on the sugar cane mealybug (*Pseudococcus calceolariae* Mask.) in Hawaii (E. S. R., 28, p. 746), and what seems to be a very closely related species, *Empusa lecanii*, has been observed on *Coccus viridis* (Green), a coffee pest in Java. A mealybug *Entomophthora* reported from Porto Rico by Johnston (E. S. R., 33, p. 459) referred to doubtfully as *E. fresenii*, may prove to be identical with this new species. A detailed technical description is given of this new species and its microscopic characters, accompanied by illustrations. The symptoms of the disease and cause are described, and an account is given of its occurrence in the grove. The bulletin concludes with a discussion of the relation of fungicides to mealybugs.

Burn the chinch bug, W. P. FLINT (*Illinois Sta. Circ. 265* (1922), pp. 4, figs. 2).—This circular calls attention to the importance of burning as a means for destroying the chinch bug.

Studies on Japanese Monophlebinae, I. KUWANA ([Japan] *Dept. Agr. and Com., Imp. Plant Quarantine Sta. Buls.* 1 (1922), pp. 58, pls. 12, figs. 2; 2, pp. 43, pls. 4, figs. 4).—The first of these two papers deals with the taxonomy and biology of the genus *Warajiococcus*, which is erected for *Monophlebus corpulentus* (Kuw.), *M. pinicola* n. sp., and *M. howardi* n. sp. The second paper is devoted to the genus *Icerya*, of which two species occur in Japan, namely, *I. purchasi* Mask. and *I. seychellarum* Westw., both of which are common and the former is a very serious citrus pest. The first paper includes a list of 32 references and the second a list of 29 references to the literature cited. Five plates relating to *Warajiococcus* are in colors, as is a plate relating to the natural enemies of *Icerya*.

The corn leaf-tier, *Ierema accius* S. & A., G. G. AINSLIE (*Fla. Ent.*, 6 (1922), No. 1, pp. 1-4, 10-14).—This is an account of one of the skipper butterflies, the larva of which attacks corn and other economic grasses in Florida, but has not as yet been known to cause appreciable damage.

The life history of *Apateticus crocatus* Uhl. (Hemiptera), W. DOWNES (*Ent. Soc. Brit. Columbia Proc., System. Ser.*, No. 16 (1920), pp. 21-27, pl. 1).—*A. crocatus*, studies of which are here reported, is of considerable economic value, since its food consists to a very large extent of caterpillars, especially tent caterpillars and larvae of the oak looper (*Elloptia somnitaria*).

***Vitula serratilincella* Rag.,** a honey-feeding larva, J. W. COCKLE (*Ent. Soc. Brit. Columbia Proc., System. Ser.*, No. 16 (1920), pp. 32, 33).—This is an account of a lepidopteran the larvae of which lie secreted under the webs in partially filled honey cells.

Entomological observations on mosquitoes in Macedonia, J. WATERSTON (*Jour. Roy. Army Med. Corps*, 38 (1922), No. 5, pp. 334-349).—This paper includes a list of 26 species and 2 varieties of mosquitoes which occur in Macedonia.

A study of the life history of the onion fly (*Hylemyia antiqua* Meig.), K. M. SMITH (*Ann. Appl. Biol.*, 9 (1922), No. 3-4, pp. 177-183, pls. 2).—This is a report of biological studies of a pest particularly abundant in Lancashire and Cheshire, where the observations were made. It is so abundant in Lancashire that in certain districts it is impossible to grow onions at all.

A new and remarkable fig midge, E. P. FELT (*Fla. Ent.*, 6 (1922), No. 1, pp. 5, 6).—A cecidomyiid reared from the fruits of *Ficus aurea* at Miami, Fla., is described as representing a new genus and species under the name *Ficiomyia perarticulata*.

On the life history and bionomics of the flax flea-beetle (*Longitarsus parvulus* Payk.), with descriptions of the hitherto unknown larval and pupal stages, J. G. RHYNEHART (*Roy. Dublin Soc. Sci. Proc., n. ser.*, 16 (1922), No. 35-39, pp. 497-541, pls. 5, figs. 2; abs. in *Rev. Appl. Ent.*, 10 (1922), Ser. A, No. 7, pp. 339, 340).—This is a report of studies of *L. parvulus*, with a discussion of allied species. The flax flea-beetle occurs all over Ulster, and in recent years has become a pest in flax-growing districts of the County of Cork and has caused considerable loss to growers. The adult seriously injures flax seedlings by eating the cotyledons and growing point, many being killed outright while others remain small and stunted. In addition to cultivated flax, its favorite food plant, the adult also attacks clovers, grasses, and species of wild flax.

In 16 days after the eggs are deposited in the soil during the months of May and June, the larvae hatch out and bore into and feed on the roots of the flax plants, but do not appear to cause any appreciable hindrance to growth. About 27 days are spent by the larvae feeding, after which they leave the

root tunnels and enter the soil, where they transform to pupae in crude cocoons of earth and from which they emerge as adults after 12 days. The complete life cycle from egg to adult is passed in about 60 days, and there is only one generation annually.

Control measures consist in the production of strong, vigorous-growing plants by approved methods and in the destruction of all hibernating quarters, especially in the vicinity of flax fields. Experiments conducted during 1921 indicate that Bordeaux mixture may act as a repellent.

A list is given of 64 references to the literature cited.

On the life history of wireworms of the genus *Agriotes* Esch., with some notes on that of *Athous haemorrhoidalis* F., III, A. W. R. ROBERTS (*Ann. Appl. Biol.*, 9 (1922), No. 3-4, pp. 306-324, pls. 2, fig. 1).—In continuation of the papers previously noted (E. S. R., 46, p. 462), the author deals with *Agriotes sputator* L., *A. sobrinus* Kies. (= *acuminatus* Steph.), *Athous haemorrhoidalis* F., and *Corymbites cupreus* F.

The clover leaf weevil (*Hypera punctata* Fab.), G. W. HERRICK and C. H. HADLEY, JR. (*New York Cornell Sta. Bul.* 411 (1922), pp. 12, pls. 2, figs. 4).—The authors report upon investigations of the life history and habits and means of control for the clover leaf weevil.

It appears that in the latitude of central New York there is in most seasons but one generation a year. Further south it is thought that a second generation may occur, it having been found by Tower and Fenton (E. S. R., 44, p. 554) that two broods sometimes occur in the latitude south of southern Indiana. The authors found the period of the first instar to vary from 9 to 14 days with an average of a trifle over 10 days, the second instar from 9 to 15 days with an average of about 12 days, and the third instar varied from 9 to 14 days with an average of about 10½ days. The pupal period averaged about 8½ days. The larva was found to spend from 2 to 5 days in spinning the cocoon and resting before it transforms to a pupa, referred to by the author as the prepupal period. A table showing the oviposition by 22 weevils, which commenced the latter part of August or early in September, is inserted. The maximum number of eggs deposited was 473 by a weevil collected on June 28, which commenced ovipositing September 9 and continued until October 29. The average number of eggs deposited by the 22 weevils observed was 174.

The fungus *Empusa sphaerosperma* is said to be by far the most effective natural control agent. It rapidly spreads from grub to grub by the spores, which are shot off and fall upon the larvae. Where infestation is sufficiently serious and prospects of injury sufficiently great, the field of clover may be sprayed with an arsenical in early May, when the larvae are apt to be particularly active. If this is attempted, arsenate of lead at the rate of 8 lbs. of the paste or 4 lbs. of powder to 100 gal. of water would be sufficient.

The taxonomy of the masarid wasps, including a monograph on the North American species, J. C. BRADLEY (*Calif. Univ. Pubs. Ent.*, 1 (1922), No. 9, pp. 369-434, pls. 15).—Several subgenera are erected, and two species of masarid wasps are described as new.

The control of red spiders in deciduous orchards, E. R. DE ONG (*California Sta. Bul.* 347 (1922), pp. 39-83, pls. 2, figs. 10).—In the first part of this bulletin the author gives an account of the life history and bionomics of three species of red spider mites that are common in deciduous orchards, namely, the common red spider or two-spotted mite (*Tetranychus telarius* L.), which attacks the trees during midsummer; the clover mite, also known as the brown or almond mite, which passes the winter in the egg stage on the tree and

feeds from the first of March to August; and the citrus mite (*Paratetranychus pilosus* C. & F.), also found on the tree during the winter in the egg stage. This is followed by discussions of the importance of red spider control, of the relation between irrigation and red spider injury, and of the dispersal of red spiders. Then follows a detailed account of studies of preventive and control measures (pp. 58-80), many of the details of which are presented in tabular form.

The studies are summarized by the author as follows: "The common red spider winters in a dormant condition or feeds upon hardy weeds and cultivated plants. There is a slow increase in numbers during the spring on wild morning-glory, Malva, and other weeds. Migration to orchard trees occurs in June or the first of July. Red spider attack results in pale, yellow leaves, followed by defoliation. Trees so affected are incapable of producing the required food for maturing the year's crop and buds for the following year. Red spider attack decreased the crop value in two prune orchards \$113 and \$453 per acre, respectively. This included loss in weight of crop and reduction in grade. Drought is usually associated with red spider injury. Thrifty trees with abundant moisture are less liable to this type of loss, but ample soil moisture is not absolute protection against red spider attacks. Timely irrigation or the control of either the spring or summer attacks of red spiders caused a marked increase in the number and the size of fruit buds in orchards attacked by red spider.

"Spraying as a control for the common red spider should be done at the time the attack usually began in previous years, even though the mites can not be seen. The spraying must be done very carefully, using 5 lbs. of sulphur (made into a paste with calcium caseinate or glue water) to 100 gal. of water. Should the spraying be delayed until the red spider is abundant, two or more applications at three weeks' intervals are usually necessary. Sprays, applied after the common red spider is numerous in the orchard or for severe attacks of the brown [clover] mite or citrus mite, should contain 1 gal. of lime sulphur concentrate (or its substitutes) to 100 gal. of mixture. The control of any species of red spider by spraying requires timely and extremely careful applications. Careless, scanty spraying is almost worthless. Cover both sides of the leaves on every part of the tree, using from 5 to 10 gal. per tree. An early application, usually about the first of July, is of far more value than late sprayings.

"Sulphur dusting is of the greatest value in regions of light wind and moderate humidity. Use a 10 per cent filler of hydrated lime in all dusting sulphurs and apply every 10 or 15 days. Three applications are usually necessary unless all conditions are very favorable. The brown [clover] mite is most easily controlled in the egg stage by winter sprays of crude oil emulsion or lime sulphur solution, winter strength. The oil emulsion may be applied at any time during the winter, but lime sulphur is more effective as the cluster buds are opening. Lime sulphur in the dry or solution forms is also of value in controlling the peach twig borer and the shot-hole fungus. If the latter pests are present, it is better to use lime sulphur than crude oil emulsion, even though the latter is more effective against the egg."

A list is given of 28 references to the literature.

The infestation of fungus cultures by mites: Its nature and control together with some remarks on the toxic properties of pyridin. S. T. JEWSON and F. TATTERSFIELD (*Ann. Appl. Biol.*, 9 (1922), No. 3-4, pp. 215-240, figs. 3).—The author reports that the infestation of pure cultures of fungi by mites is a considerable source of trouble in mycological laboratories. In-

vestigations were conducted at Rothamsted, where such infestation had occurred, with a view to discovering a method of control. The species most frequently met with are *Aleurobius farinae* and *Tyroglyphus longior*, with an occasional infestation with *Glyciphagus cadaverum*. It was found that they could be controlled by exposing the cultures to the vapor of pyridin, after which the fungi can be subcultured safely. When the pests occur in laboratory apparatus, they can be eliminated by the application of strong ammonia.

A list of the new gregarines described from 1911 to 1920, M. W. KAMM (*Amer. Micros. Soc. Trans.*, 41 (1922), No. 3, pp. 122-152).—In addition to annotated lists of species of the tribes Cephalina and Acephalina of the suborder Eugregarinae and of the species of the suborder Schizogregarinae, a list is given of hosts with their gregarine parasites (pp. 148-152).

FOODS—HUMAN NUTRITION.

An outline of the Pirquet system of nutrition, C. PIQUET (*Philadelphia and London: W. B. Saunders Co.*, 1922, pp. 96).—This small volume, which is based on a series of lectures on modern pediatrics delivered at Yale University in 1921-22, presents in a concise form the principles and methods of application of the author's new system of nutrition. A bibliography of the subject from the years 1917 to 1922, the new values of the principal foodstuffs, and a table of Pellidisi indices are appended.

Public health methods and their application in Portland.—A preliminary study by the Public Health Bureau of the City Club of Portland, N. E. WAYSON ET AL. (*Portland, Oreg.: City Club, Pub. Health Bur.*, 1922, pp. 40).—As the subtitle states, an account is given of the activities of the local bureau of health, sanitary engineering, public health, and social service work, also information regarding food, milk, meat, and restaurant inspection, maternal and infant welfare work, sewage and garbage disposal, and related questions.

Studies of human mixed saliva, I, II, H. E. STARR (*Jour. Biol. Chem.*, 54 (1922), No. 1, pp. 43-64, figs. 4).—Two papers are presented.

I. The determination of the H-ion concentration of human mixed saliva (pp. 43-54).—The method adopted by the author for determining the H-ion concentration of saliva is essentially the colorimetric procedure of Clark, using dibromothymolsulfonephthalein as an indicator. The saliva is collected under oil in a clean receiver, and the proper dilution in distilled water is also made under oil. The dilution of 1:9 was used in most of the tests reported. In the collection of the specimens the use of any activator such as paraffin was found to result in an increase in the pH value of the saliva such as to render the results inaccurate. Exposure to air and centrifugation were also found to alter the pH values of the saliva.

II. Variations in the H-ion concentration of human mixed saliva (pp. 55-64).—This paper reports the variations in the H-ion concentration of saliva as determined by the above method under a wide variety of conditions. The H-ion concentration of saliva was found to vary directly with the alveolar CO₂ after the noon meal and inversely with the H-ion concentration of the urine after the ingestion of large doses of sodium bicarbonate. Forced vigorous breathing in the open air, with mouth closed, resulted in a lowering of the H-ion concentration. Fatigue appeared to cause an increase in H-ion concentration, and emotional excitement a decrease. The extreme variations in the H-ion concentration of 610 specimens of saliva collected from 228 healthy normal subjects were from pH 5.75 to 7.05. The pH values of 86 per cent of the specimens were between 6.35 and 6.80, inclusive.

Calcium and phosphorus metabolism in childhood, H. C. SHERMAN and E. HAWLEY (*Jour. Biol. Chem.*, 53 (1922), No. 2, pp. 375-399).—An extensive investigation is reported of the rate of storage of calcium in normal children of different ages, and of the nature and amount of the intake required to support optimum calcium storage in the growing child. Four series of studies were made, the scope and general results of which are briefly as follows:

To determine the relation of calcium retention to age, the balance of intake and output of calcium and phosphorus during a period of 9 days was studied in 12 normal children from 3 to 13 years of age, receiving a normal mixed diet including a fixed allowance of 750 gm. of milk per child per day and supplying a calcium intake of about 1 gm. per child per day. On this diet the calcium retention varied from 0.15 to 0.62 gm. per day, increasing with the age of the child. The phosphorus retention ranged from 0.09 to 0.53 gm. per day. Calculated to the basis of size, this represented an average daily storage of 0.01 gm. of calcium and 0.008 gm. of phosphorus per kilogram of body weight per day.

The next series of studies was planned to determine the daily allowance of milk necessary for optimum storage of calcium in the growing child. Three children in the first group, 4, 5, and 12 years of age, respectively, were kept under continuous observation, with quantitative determination of the intake and output of calcium and phosphorus for 8 periods of 6 days each, the calcium intake being varied from period to period by changes in the amount of milk. In this study it was found that the increase in the allowance of milk from 750 to 1,000 gm. per child per day resulted in a 70 per cent increase in the average storage of calcium (0.017 gm. as against 0.01 gm. per kilogram of body weight per day). When the milk was increased to 1,500 gm. the retention of calcium was not greatly increased over that on 1,000 gm. These results are thought to indicate that the optimum storage of calcium in growing children is made when the diet contains about 1,000 gm., or roughly 1 qt. of milk per day for each child. This, together with the usual allowance of other foods, would represent an intake of rather more than 1 gm. of calcium per day.

In the third and fourth series of experiments a study was made of the relative value of vegetables and milk as sources of calcium. In series 3 the same 3 children were used as in the second series, and calcium and phosphorus balances were determined continuously for 3 periods of 9 days each. In the first and third periods each child received 500 gm. of milk in addition to a mixed diet, while in the second period the diet was changed by substituting for potatoes in the original diet sufficient carrots and spinach to furnish an amount of calcium equal to that which would have been furnished by another 500 gm. of milk. In series 4, 3 other children were used in an experiment covering the same length of time, but differing from series 3 in that in the first and third periods 750 gm. of milk was given daily, while in the second one-half of the milk was replaced by sufficient vegetables to furnish the same amount of calcium. In both series of experiments the calcium balance was more variable and lower when the vegetables supplied some of the calcium. It is concluded that growing children utilize the calcium of milk to better advantage than the calcium of vegetables. The phosphorus storage during the same periods was quite variable. In some cases there appeared to be as great a storage of phosphorus from the vegetable-rich as from the milk-rich diets, while in others the phosphorus balance was unfavorably affected by the substitution of vegetables for milk.

In considering the bearing of these results upon standards of calcium in family dietaries, attention is called to the fact that the estimated calcium requirement for children of 1 gm. per day is considerably higher than the 0.68 gm. previously given as the dietary standard for adults (E. S. R., 44, p. 563),

and that in consequence it would be advisable in all cases in which the group of people to be fed includes growing children to adopt a higher dietary standard for calcium, at least 1 gm. per man per day. "In view of the results obtained with different foods as sources of calcium, it is desirable also to emphasize the importance of a quart of milk per day for every child, and it would be best to maintain this level of milk intake up to at least the age of 12 to 14 years."

The metabolism of sulphur.—V, Cystein as an intermediary product in the metabolism of cystin, H. B. LEWIS and D. A. MCGINTY (*Jour. Biol. Chem.*, 53 (1922), No. 2, pp. 349-356).—Evidence is presented that the unoxidized sulphur derivative present in the urine of rabbits following the administration of phenyluraminocystin (E. S. R., 47, p. 167) is phenyluraminocystein. "This furnishes evidence that the first stage in the catabolism of cystin is conversion to cystein with subsequent deamination and oxidation of the latter. In the case of phenyluraminocystein, deamination has been prevented by conjugation, and the cystein derivative is probably excreted as such in the urine."

The mineral content of the normal white rat during growth, G. D. BUCKNER and A. M. PETER (*Jour. Biol. Chem.*, 54 (1922), No. 1, pp. 5-9).—This contribution from the Kentucky Experiment Station consists of the reports of analyses of the ash of the carcasses of normal white rats at different ages and raised under similar conditions. For each analysis a composite sample of the ash of three animals of the same sex and from the same litter was used. The data reported include figures for the weight of carcass and crude ash and the percentage of ash of males and females from 2 to 40 weeks of age at 2-week intervals and of the percentage composition of the crude ash. From these figures the average percentages of the constituents of the ash in terms of the whole carcass were calculated, and also the oxygen ratio of $P_2O_5:CaO+MgO$ and of $CaO:MgO$ at the different ages.

Individual variations make the results obtained difficult of interpretation and generalization. "It is interesting to note that at the age of 2 weeks the oxygen ratio of $CaO+MgO:P_2O_5$ approximates that of tricalcium phosphate (1.67), whereas for the older rats this ration falls between that and the ratio for dicalcium phosphate (2.5), and that the ratio of calcium to magnesium and to potassium is sensibly the same for both sexes and all ages."

On a type of ophthalmia caused by unsatisfactory relations in the inorganic portion of the diet.—An ophthalmia not due to starvation for fat-soluble A, and not curable by its administration, E. V. MCCOLLUM, N. SIMMONDS, and J. E. BECKER (*Jour. Biol. Chem.*, 53 (1922), No. 2, pp. 313-321).—The authors report the occurrence of an eye condition similar to if not identical with the xerophthalmia caused by lack of vitamin A in rats on certain diets containing a sufficiency of vitamin A. An analysis of the various diets involved is reported, and the conclusion is drawn that the one constant factor that might be held responsible for the causation of ophthalmia was a high content of chlorin.

"It is possible, however, that a high sodium content in the diet may contribute to cause this pathological condition. We suggest provisionally, therefore, that these are the etiological factors involved in inducing an eye condition which may be easily confused with the xerophthalmia due to lack of fat-soluble A. It may, of course, be found that the provision of excessive amounts of certain other inorganic elements may intensify the effect of chlorin, or sodium or both, in hastening the onset of the eye disease. The whole question of the interrelation of salt effects in mammalian nutrition is still little understood."

Faulty diet and its relation to the structure of bone, P. G. SHIPLEY (*Jour. Amer. Med. Assoc.*, 79 (1922), No. 19, pp. 1563, 1564).—A general discussion.

Decalcification of teeth and bones, and regeneration of bone through diet. P. R. HOWE (*Jour. Amer. Med. Assoc.*, 79 (1922), No. 19, pp. 1565-1567, figs. 8).—This paper is based on the examination of the pathological condition of the bones and teeth of guinea pigs and monkeys on a diet lacking in vitamin C, but furnishing sufficient vitamin A and B. In guinea pigs on this diet the teeth became extensively decalcified in 14 weeks, during which time the other well-known symptoms of scurvy developed. In monkeys on the scorbutic diet the mouth became filthy, with excessive tartar formation, and the teeth became loose. Pathological conditions in the eyes of both monkeys and guinea pigs were also noted. These disappeared on the administration of orange juice.

The relation of nutrition to tooth development and tooth preservation. I. E. V. MCCOLLUM, N. SIMMONDS, and E. M. KINNEY (*Bul. Johns Hopkins Hosp.*, 33 (1922), No. 376, pp. 202-215, pls. 2, figs. 13).—A preliminary study is reported of the gross defects in the teeth of 220 rats on 57 of the various diets used by the authors in the series of studies on experimental rickets in rats. Several of the diets representing typical deficiencies found in the ordinary American diet are described, with growth curves of the animals on the respective diets. The gross defects of the teeth are classified under six headings, including caries-like lesions and loss of attaching tissues and teeth in molars, fractures in incisors and molars, and osteodentin and pulp exposure, overgrowth, and loss of maxillary and mandibular areas in incisors. Tables are given showing the percentage of dental defects as thus classified in rats restricted to diets of different character, and the various defects are also illustrated photographically.

As averaged from the six groups of defects, 79.2 per cent of the 106 males and 84.1 per cent of the 114 females were found to have oral defects. Twenty-seven of the females reared litters successfully, but 92.2 per cent of the offspring were orally defective. In contrast to this, it is stated that the stock rats on a presumably optimum diet showed only 0.36 per cent of defects, and that these resulted only from fracture or overgrowth.

The percentage of oral defects was said to be greatest in the rats fed diets deficient in protein, calcium, and vitamin A, next in those fed diets low in calcium, and third in those fed diets low in both calcium and vitamin A. The authors conclude "that severe oral disease may result from diets which are only relatively defective, where the disturbance appears to be out of all proportion to the cause. In these border-line phases, the dietary defect or deficiency is minute and can only be determined by careful scrutiny of the diet and patient, or of the animals over a considerable period.

"It is not possible at this time to name any one deficiency which specifically causes dental or oral disease. It would appear that any slight variation in the American diet, which always so dangerously approaches the level of dietary deficiency, might become active at any period of lowered resistance or of physical or nervous stress."

The effect of defective diets on teeth.—The relation of calcium, phosphorus, and organic factors to caries-like and attaching-tissue defects, C. J. GRIEVES (*Jour. Amer. Med. Assoc.*, 79 (1922), No. 19, pp. 1567-1573, figs. 6).—A more detailed study is reported of the oral lesions in 85 rats on five diets selected from the 57 of the above study to represent three groups of deficiencies as noted below. On these diets 36 per cent of the males and 44 per cent of the females showed caries-like and attaching-tissue defects of the teeth. In group 1, the diets of which were characterized by being low in calcium alone, 22 per cent of the rats showed caries-like defects and 41 per cent attaching-tissue lesions. In group 2, the diets of which were low in calcium

and vitamin A, 31 per cent of the rats showed caries-like defects and 20 per cent attaching-tissue defects. In group 3, on diets characterized by high calcium, 17 per cent of the rats showed caries-like defects and 28 per cent attaching-tissue defects.

Detailed descriptions are given of both types of lesions. The author concludes that the most important factor in the formation and maintenance of normal bones and teeth, with healthy attaching tissues, is a proper balance of calcium, phosphorus, and the organic factor present in cod liver oil.

The influence of parathyroidectomy on the skeleton of animals normally nourished, and on rickets and osteomalacia produced by deficient diet, V. KORENCHIEVSKY (*Jour. Path. and Bact.*, 25 (1922), No. 3, pp. 366-392, pls. 2).—The literature on the influence of the parathyroid gland upon calcium metabolism and its significance in rickets is reviewed, and an investigation is reported of the following questions: (1) Whether the removal of the parathyroid glands in normal rats on a normal diet results in rickets or osteomalacia, and (2) whether the removal of these glands from rats on diets deficient in calcium, vitamin A, or both these factors increases the changes in the skeleton resulting from such deficiencies in the diet. In all 35 rats were used, from 24 of which the parathyroids were successfully removed. The basal diet consisted of purified casein 18, starch 52, fat 15, and marmite 5 gm., and orange juice 5 and distilled water 50 cc. This mixture contained about 0.041 per cent of calcium and 0.22 per cent phosphorus. When the diet was intended to be rich in vitamin A the fat consisted of a mixture of 12.5 gm. of butter and 2.5 gm. of cod liver oil, and when deficient in vitamin A cottonseed oil was used. To the basal diet was added 5 gm. of salt mixture, containing in one case 16.2 per cent of calcium phosphate and in the other no calcium. The feeding was continued for 90 days in the first and 68 days in the second experiment, after which the animals were killed and autopsied, and determinations made of the calcium in the bones.

From the results of the observations reported, the author concludes that the removal of the parathyroids affects the teeth in a manner similar to the use of diets deficient in calcium, vitamin A, or both these factors, but that it produces no marked effect on the skeleton of rats kept on normal or rickets-producing diets. The results are also thought to confirm previous conclusions that the changes typical of rickets or osteomalacia occur most readily and frequently in rats kept on a diet deficient in both vitamin A and calcium, and that there is no essential distinction between rickets and osteomalacia, the only modifying influence being age.

Present status of our knowledge of the vitamins and its application to the dietary, H. C. SHERMAN ET AL. (*Amer. Jour. Pub. Health*, 12 (1922), No. 11, pp. 908-915; also in *Amer. Food Jour.*, 17 (1922), No. 12, pp. 19-22).—This paper, which was prepared by the committee on nutritional problems of the American Public Health Association for presentation at the annual meeting held at Cleveland, Ohio, October 17, 1922, consists of a brief summary of present knowledge of vitamins A, B, and C, with particular reference to the physiological effects caused by their deficiency in the diet and to the chief sources of these vitamins among our natural foods. In the latter connection the statement is made that "it can safely be said that milk in its various forms is the most important and economical source of vitamin A, while supplying also liberal amounts of vitamin B and significant quantities of vitamin C, and that the fruits and vegetables, while varying widely among themselves, are as a group a very important source of vitamins B and C."

Concerning the liberal use of milk, it is asserted that "milk may be in any of the now standard forms—raw, pasteurized, canned, or dried. There is no

evidence of any measurable effect upon vitamin A or B when milk is properly pasteurized, condensed, or dried. Under what conditions and to what extent, if any, these processes influence the vitamin C content is a matter of active investigation at the present time."

Cod liver oil and vitamin A (*Brit. Med. Jour.*, No. 3222 (1922), p. 610).—An editorial review of recent papers by Drummond et al. which have been noted from their original sources.

Contribution to the study of the metabolism of pigeons deprived of vitamin B, F. CARIDBOIT (*Jour. Physiol. et Path. Gén.*, 20 (1922), No. 2, pp. 189-192).—Data are reported on the intensity of respiration as measured by the volume of CO₂ evolved, the respiratory quotient, and the nitrogen excretion of five pigeons at intervals of about five days for a period of nearly a month. Four of the pigeons were fed polished rice and one buckwheat. One of the pigeons on the polished-rice diet received daily a subcutaneous injection of 0.42 mg. of histamin. The carbon dioxide determinations were made on samples of air obtained from a large bell jar in which the individual pigeons had been kept for 30 minutes. The data reported also include the body temperature of the pigeons and their weight and food intake.

The pigeons fed polished rice consumed decreasing amounts of the rice, while the food intake of the control pigeon on buckwheat remained constant. The pigeon receiving daily injections of histamin ate more than the other rice-fed pigeons, but also showed loss of appetite toward the end of the experiment.

The respiratory intensity (CO₂ evolved) remained nearly constant with the control pigeon, but showed a regular decrease in the rice-fed pigeons. The respiratory quotient averaged 0.95 for the control pigeon, and for the rice-fed pigeons fluctuated from 0.9 to 0.7 and then to 0.8. In explanation of this, the author suggests that the pigeon first oxidizes carbohydrates and then fat, and finally its tissue proteins. There was a decided diminution in nitrogen excretion in the rice-fed pigeons. The data taken as a whole are thought to indicate that injections of histamin do not modify to a marked extent the respiratory metabolism of polyneuritic pigeons.

Tadpoles, biological reagents for the study of the vitamins of growth, G. BALLARD (*Jour. Physiol. et Path. Gén.*, 20 (1922), No. 2, pp. 182-188, fig. 1).—A study is reported of the growth and metamorphosis of the larvae of the frog, *Rana esculenta*, on different diets. The larvae were placed in groups of five in a series of Leclainché cells and the water changed daily by emptying the contents of each cell into a fine sieve under running water.

When the food consisted entirely of the ground entire grains of beans, peas, lentils, wheat, barley, and rye, metamorphosis was complete in 9 weeks. Kidney beans and oats proved toxic to the larvae, death resulting in 7 and 9 days, respectively. With decorticated grains and flour of different percentage extraction, growth was inhibited and metamorphosis did not take place. On a diet of egg yolk metamorphosis was complete in 8 weeks, and on veal and mutton tissue in 9 weeks. On cooked egg white alone death resulted in about a month. On egg white and beef fat the larvae remained agile, but developed very slowly. On egg white and wheat starch symptoms similar to beriberi appeared in about 10 weeks, and on egg white, beef fat, and starch, the larvae became dropsical as in wet beriberi.

In the various egg-white experiments, observations were also made of the effect of placing green algae in the water and not changing the water. When egg white alone was fed the algae grew very slowly at first, but in about 3 weeks began to grow normally and the larvae no longer died, but did not grow perceptibly. In the experiments with egg white and fat the algae grew more

rapidly, and coincident with the increased growth of the algae the larvae began to grow and metamorphosis was completed in 12 weeks. The author concludes that, by symbiosis of the animal with the bacterial flora and chlorophyll, a new substance has been created at the expense of the deficient diet, and that this new substance has played the rôle of a growth-promoting vitamin.

Bacterial food poisoning from mutton, W. A. YOUNG and G. D. DAWSON (*Lancet* [London], 1922, II, No. 12, pp. 608, 609).—A brief report is given of an outbreak of food poisoning in Manchester, England, involving 25 persons in six households and resulting in one death. The infection was definitely traced to mutton purchased from the same retailer. From the remains of a roast of this mutton and from the tissues and secretions of the fatal case there was isolated a strain of *Bacillus suispestifer* or *aertrycke*, type Mutton. The blood of most of the individuals attacked agglutinated this bacillus in relatively high dilution.

ANIMAL PRODUCTION.

Genetics, H. E. WALTER (*New York: Macmillan Co.*, [2.] ed., rev. and enl., pp. XVI+354, pls. 3, figs. 88).—This is a revised edition of the book previously noted (E. S. R., 28, p. 876), many parts of which have been rewritten or rearranged to bring the book up to date. New material has been added, dealing with linkage, crossing over, the location of genes and somatogenesis, as well as the entire rewriting of the chapter on the determination of sex.

Ten years of heredity, A. F. SHULL (*Amer. Micros. Soc. Trans.*, 41 (1922), No. 2, pp. 82-100, figs. 8).—This is a review of the conception of linkage, crossing over, and the arrangement of factors in the chromosomes.

Coefficients of inbreeding and relationship, S. WRIGHT (*Amer. Nat.*, 56 (1922), No. 645, pp. 330-338).—The author shows the method of derivation, largely from the formula of path coefficients¹ (E. S. R., 44, p. 766), of the formula

$$fo = \Sigma (1/2^{n+n'} + 1) + fa$$

for calculating the coefficient of inbreeding (fo), in which n and n' are the number of generations from the sire and dam, respectively, to each common ancestor, and fa is the coefficient of inbreeding of those animals. The possible values derived according to this formula range from 0 to 1. To demonstrate the practical application of the formula, the coefficient of inbreeding was determined for the Shorthorn bulls Roan Gauntlet and Comet to be 0.141 and 0.4687, respectively.

Remarks on the method of calculation proposed by H. L. Trachtenberg for diallel crossings, K. SMITH (*Jour. Genetics*, 11 (1921), No. 3, pp. 299, 300).—This is a criticism of the suggestion of Trachtenberg (E. S. R., 46, p. 268) for estimating the generative value of parents, in which the author states that in getting away from an arbitrary assumption, he has replaced it by an unmaintainable assumption. Though the fundamental principles of Trachtenberg's method are deemed wrong, it gives fairly good results because of the small number of parental observations and the large number of observations on offspring.

Synthetic Mendelian forms in animals, J. L. FRATEUR (*Genetica* [The Hague], 4 (1922), No. 3-4, pp. 235-246).—The author reports the production of rabbits and poultry possessing characters or combinations of characters not shown by either parent. He states that these so-called synthetic forms are of two types, those which result from a combination of the factors of two different

¹ *Genetics*, 6 (1921), No. 2, pp. 111-178.

genotypes and those which result from offspring taking one character from one parent and a second character from the other parent.

Examples which he has obtained in experiments of the first type are the production of rabbits with the wild type of coat color from crosses of albinos and other colors not agouti carrying the agouti factor with black, blue, and pearl gray coated rabbits, or crossing pea comb and rose comb fowls with the production of offspring with walnut combs. Examples of the second type of synthetic Mendelian forms are the production of white pea comb fowls by crossing black pea comb birds with others having single combs and white feathers, and short haired rabbits with wild type coat by crossing Angora rabbits with wild type coat with short haired rabbits of other colors.

The interaction between two closely linked lethals in *Drosophila* as the cause of the apparent constancy of the mutant "spread," Ö. WINGE (*Genetica [The Hague]*, 4 (1922), No. 3-4, pp. 321-338, figs. 2).—In experiments with cultures of *D. melanogaster* showing the mutant condition of spread wings at the genetics laboratory of the Royal Veterinary and Agricultural College, Denmark, the author has obtained data to show that, contrary to the literature, spread wings are dominant to normal wings. The spread wing cultures which are apparently homozygous are really heterozygous, and seem to breed true because the spread factor in double doses has a lethal effect. A recessive lethal factor is closely linked to the allelomorph of the spread factor, so that, except for a few crossovers (a few normal winged individuals occur), all individuals homozygous for spread wing and nearly all homozygous for the recessive allelomorph die. Thus a heterozygous race by the possible interaction of two lethal factors is made to breed practically as a homozygous race.

Zygodactyly and its inheritance, A. H. SCHULTZ (*Jour. Heredity*, 13 (1922), No. 3, pp. 115-118, figs. 8).—Referring to a previous article on the inheritance of webbed toes (*E. S. R.*, 48, p. 66), the author reviews the inheritance of several cases of webbed toes. He concludes that those individuals that are free from the condition do not transmit it, and that the chances of a web-toed female transmitting the condition to her children are less than those for a male to transmit this condition.

The effects of inbreeding and crossbreeding on guinea pigs.—III, Crosses between highly inbred families, S. WRIGHT (*U. S. Dept. Agr. Bul.* 1121 (1922), pp. 61, figs. 27).—Continuing the studies of the effects of inbreeding and crossbreeding (*E. S. R.*, 48, p. 263), individuals from five of the inbred families showing extreme differences in certain characters were mated together from 1916 to 1919 to study the effect of crossbreeding on vigor. The methods of crossbreeding have been designated by symbols. B refers to the control stock mentioned in the previous papers in which no matings closer than second cousins were made. CO refers to first crosses between the different inbred families. The breeding together of individuals from two CO crosses in which different inbred families were used in each case has been designated as CC. Matings between brother and sister which have come from a CO cross are designated as C₁, and a second generation of brother and sister matings has been designated as C₂. CA refers to matings of inbred females with males from CO crosses, and AC refers to the reciprocal cross. CG designates matings of crossbred individuals which were exceptionally heavy at weaning time, and CL designates matings of crossbreds from large litters.

It was necessary to make some corrections in the results of the experiments for the effect of differences in the size of litters and seasonal variations. The existing differences for the characters studied in the stocks of different breed-

ing are presented in tabular form. A summary of the corrected data appears in the following table:

Average of the records of inbred and crossbred stock, 1916-1919.

Experiment.	Born alive.	Raised of those born alive.	Raised of all born.	Total birth weight.	Birth weight of those raised.	Gain per day.	Weight at 33 days.	Size of litter.	Litters per year.	Young per year.	Young raised per year.
	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Gm.</i>	<i>Gm.</i>	<i>Gm.</i>	<i>Gm.</i>				
Inbred.....	77.7	72.1	56.3	71.8	77.6	3.64	197.8	2.33	3.18	7.40	3.96
CO.....	79.0	74.1	58.8	71.0	76.4	3.64	196.6	2.31	3.18	7.35	4.09
CA.....	83.6	83.0	70.1	77.9	81.0	4.02	213.8	2.41	3.48	8.42	5.42
AC.....	83.3	83.2	69.4	78.2	81.7	4.12	217.7	2.41	3.49	8.45	5.51
CC.....	79.9	72.6	58.9	70.0	75.2	3.71	197.6	2.27	3.22	7.31	4.17
CI.....	79.8	73.5	59.6	71.2	76.3	3.77	200.8	2.29	3.25	7.46	4.31
C2.....	82.3	78.9	65.3	74.8	79.3	4.10	214.5	2.33	3.40	7.96	4.94
CL.....	83.4	83.3	69.5	78.2	81.7	4.10	217.0	2.42	3.47	8.38	5.32
CG.....	82.6	81.9	67.5	77.4	81.3	4.10	216.6	2.40	3.48	8.39	5.32
B.....	78.4	73.3	58.2	72.1	77.3	3.66	198.0	2.32	3.22	7.51	4.19

In discussing the results, the author found that crossbreeding resulted in marked improvement in every respect over inbreeding, but that the greatest improvement in percentage born alive, birth weight, size of litter, and frequency of litters did not occur until the second generation. The gains, adult weight, percentage raised of those born alive, and resistance to tuberculosis showed greatest improvement in the first generation. Based on the averages as given in the above table, a series of graphs were constructed from which the proportionate influence of different factors in determining the different characters has been calculated.

An interesting method used in making these determinations was by comparing the results of AC and CA crosses, from which the influence on the offspring of a crossbred sire or dam could be determined since the other parent was inbred. Environment was found to play a large part in determining some of the characters. As far as heredity was concerned, the percentage of the young born alive and percentage raised of the young born alive and birth weight were found to depend primarily on the breeding of the dam, the crossbred dams being much superior to the inbred dams in these respects. In the case of the birth rate and still more in the case of the percentage raised of the young born alive, the heredity of the young seems to have some influence. The daily gains were found to be largely influenced by the heredity of the young, but the breeding of the dam was also found to be of much importance. The frequency and size of litters were found to be dependent upon both parents, but with the first character the breeding of the sire seemed to be more responsible, whereas in the latter character the dam was almost entirely responsible. The percentage raised of all young born, the weight at weaning, and the total fertility are really the products of other characters discussed. The selection practiced in the CG and CL matings seemed to have no effect on the weights of the offspring, though the offspring of the large animals proved to be somewhat earlier maturing.

A method of calculating the decrease in heterozygosis occurring in successive generations of inbreeding by different systems of mating is presented, and the application to the results of this study is discussed. Inbreeding naturally results in an increase in homozygosis, and thus more recessive factors are allowed to express themselves. More of the characters denoting lack of vigor seem to be determined by recessive factors, which thus results in decreased vigor in the inbred strains. Crossing produces increased vigor, because each family supplies some dominant character which the other lacks. The establishment of a num-

ber of inbred lines and then crossing between them to maintain vigor is advocated for practical live stock improvement.

Notes on the hybrids between the canary and two American finches. O. E. PLATH (*Amer. Nat.*, 56 (1922), No. 645, pp. 322-329).—The author reports the production of hybrids between a yellow canary female and males of the California linnet (*Carpodacus mexicanus frontalis*) and the willow goldfinch (*Astragalinus tristis salicamans*). In the first cross three, and in the second cross five, hybrids were produced. Four hybrids were also produced by crossing a willow goldfinch female with an Arkansas goldfinch (*A. psaltria hesperophilus*), but they died a few days after hatching. The canary-California linnet hybrids were sterile when mated with each other, and the male was sterile when mated with a canary female. A description of the hybrids is given, as well as discussions of similar crosses which have been reported in the literature.

Genetic studies in poultry.—IV, On the barred plumage of certain breeds. R. C. PUNNETT and M. S. PEASE (*Jour. Genetics*, 11 (1921), No. 3, pp. 235-240, figs. 2).—In continuing the genetic studies in poultry (E. S. R., 46, p. 272), experiments are reported in which an effort was made to study the relationship of the white and gold bars of the Chamois Campine (feathering is barred with white and gold) to the black and gold of Gold Campines and the black and white of Silver Campines. Crosses were made between a Chamois cock and Brown Leghorn and Silver Campine hens and between a Chamois hen and Gold and Silver Campine cocks. The results of these crosses indicated that silver is produced from gold by the action of a sex-linked factor which inhibits gold. The Chamois differs from gold by the action of a factor which inhibits dark melanic pigment without influencing the gold. The presence of both inhibitors produces white. The occurrence of faint barring, called ghost barring, in the heterozygous whites as they got older was also noted, and is attributed to the heterozygous condition of the birds for the inhibitor of the melanic pigment, since the ghost bars occupy the position of the black bars in the feather.

Experimental studies on the duration of life.—IV, Data on the influence of density of population on duration of life in *Drosophila*. R. PEARL and S. L. PARKER (*Amer. Nat.*, 56 (1922), No. 645, pp. 312-321, figs. 3).—Continuing the studies on duration of life in *Drosophila* (E. S. R., 47, p. 864), data are presented which have been taken from three different strains, including 13,117 individuals, showing the effect of the density of the population on the length of life by means of correlation tables and graphs for each strain. The tentative conclusions to be drawn are that there is an optimum density of population for maximum duration of life in *Drosophila*, either below or above which the length of life is shortened.

The sex chromosomes of the monkey. T. S. PAINTER (*Science*, 56 (1922), No. 1445, pp. 286, 287, figs. 4).—In studying the spermatogenesis of the ring-tail monkey at the University of Texas, 54 chromosomes have been observed in dividing spermatogonia. During the first maturation division an element is noted which consists of two components unequal in size and which go to opposite poles of the cell, so that the secondary spermatocytes contain one or the other of these components, which are the X and Y chromosomes.

Oestrus and fecundity in the guinea pig. D. B. TRESIDDER (*Amer. Nat.*, 56 (1922), No. 645, pp. 347-359).—In this study, carried on at the Stanford Medical School, the author made observations on the occurrence of oestrus in the guinea pig considering the age of first occurrence, the time lapsing between parturition and oestrus, and the regularity of occurrence in nonpregnant

animals which had and had not been mated. Parturition was usually followed almost immediately by oestrus, after which it occurred again in from 12 to 120 days, usually depending upon the age of the animal. The recurrence of oestrus was usually at 15 or multiple of 15-day intervals. The number of embryos in pregnant guinea pigs killed at daily intervals from 7 to 15 days of pregnancy and at 2-day intervals from then to parturition showed very close agreement, with the number of corpora lutea found in the ovaries. The number of embryos in each horn of the uterus also corresponded with the number of corpora lutea found in the ovary on that side.

Loss in the grain of corn in storage as silage, W. L. GAINES (*Jour. Dairy Sci.*, 5 (1922), No. 5, pp. 507-509).—In comparing the dry matter changes in the grain of Silvermine corn as stored in the silo and in the crib, it was determined at the Illinois Experiment Station that the grain stored in the silo lost 5.08 per cent of the dry matter and that stored in the crib 2.25 per cent.

The effect of feeding velvet beans to pigeons, W. D. SALMON (*Science*, 56 (1922), No. 1448, p. 368).—In experiments at the South Carolina Experiment Station, pigeons fed velvet beans with and without an aqueous extract of rice bran and 10 per cent of butter fat did not do well and two died on the fourth day. Pigeons which showed symptoms of polyneuritis due to a polished rice diet partially recovered after feeding velvet beans. An aqueous extract of velvet beans fed to pigeons on the polished rice diet apparently delayed the occurrence of polyneuritis. It is concluded that velvet beans at least contain a small amount of vitamin B, but the cause of their ill effects on the pigeons has not been determined.

Cat-tail (*Typha latifolia*) as a feed, L. E. FREUDENTHAL (*Science*, 55 (1922), No. 1426, pp. 456, 457).—The author reports results in which 60 hogs obtained sufficient nutrients to keep them in good condition for three months on the cat-tail rhizomes which they picked up in a 3-acre swamp. The analysis of cat-tail flour is shown to agree very closely with yellow corn, the main differences being more ash and less fat than in the corn.

The value of fish meal as a feeding stuff, J. B. ORR and A. CRICHTON (*Scot. Jour. Agr.*, 5 (1922), No. 2, pp. 146-157).—After briefly describing the different methods of manufacturing fish meal, the authors briefly report several feeding experiments carried on at Rowett Research Institute in which white fish meal made from the heads, bones, and flesh of fresh white fish was fed to hogs, poultry, and dairy cattle without any fishy odor being noticeable in the pork, bacon, eggs, milk, or poultry meat. Poor quality fish meals, however, were found to taint the bacon in some cases unless the feeding of the fish meal was stopped four weeks before killing. The desirability of fish meal as a source of protein and minerals is also brought out.

Studies in animal nutrition.—II, Changes in proportions of carcass and offal on different planes of nutrition, C. R. MOULTON, P. F. TROWBRIDGE, and L. D. HAIGH (*Missouri Sta. Research Bul.* 54 (1922), pp. 3-76, pl. 1, figs. 27).—Thirty-one representative steers from each of the groups on the different planes of nutrition previously described (*E. S. R.*, 46, p. 66) were slaughtered at intervals of from 3 months to 4 years of age, and records were taken of the weights of the live animals, intestinal contents, blood, heart, lungs, trachea, brain, spinal cord, tongue, gullet, rumen, reticulum, omasum, abomasum, large and small intestines, sweetbreads, spleen, pancreas, liver, gall bladder, gall, kidneys, urinary bladder, penis, diaphragm, caul fat, stomach fat, intestinal fat, hide, hair, dewclaws, teeth, horns, hoofs, foot and hoof, quarters, and of the wholesale cuts showing the amount of lean, fat, and bone each cut contained. The following table shows the proportion of the weight of the animals which

consisted of the different parts when the animals on different planes of nutrition were slaughtered at different ages:

Proportions of carcass and offal on the warm empty weight¹ basis in animals of different ages on (1) full, (2) limited, and (3) scant planes of nutrition.

Age.	Plane of nutrition.	Warm empty weight as percentage of live weight.	Proportion of warm empty weight.						
			Carcass.	Offal fat.	Hide and hair.	Head, tail, feet, etc.	Blood.	Organs.	Loss on cooling.
<i>Mos.</i>			<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>
3.....	1	88.02	61.56	1.43	10.51	6.94	6.24	11.71	1.45
3.....	2	89.27	64.21	.83	9.48	7.95	5.35	10.78	.38
3.....	3	83.89	63.92	.65	9.26	7.95	6.37	11.94	.03
5.6.....	1	84.32	63.70	3.91	8.16	6.13	5.18	11.48	.42
5.2.....	2	85.29	62.14	1.80	10.60	8.13	5.25	10.77	.72
5.3.....	3	86.63	62.78	.98	9.72	8.68	5.35	11.22	1.93
8.2.....	1	83.16	65.14	2.26	8.53	6.88	5.08	11.56	.04
8.5.....	2	82.28	61.33	2.16	8.62	7.41	5.85	12.46	1.14
8.4.....	3	83.19	61.41	.92	9.04	9.21	5.19	12.37	1.03
10.7.....	1	89.03	65.82	3.59	9.22	4.78	4.33	9.82	2.79
10.9.....	2	87.83	61.09	2.17	9.65	6.24	4.54	11.25	2.93
11.1.....	3	87.10	63.41	1.68	9.44	6.54	5.06	11.37	4.31
10.6.....	1	87.57	64.46	4.66	8.39	4.88	5.03	10.22	1.97
11.4.....	2	87.38	61.85	3.12	9.78	6.44	5.52	10.86	1.34
17.7.....	1	88.77	68.11	5.16	7.40	4.38	4.09	8.67	2.19
18.4.....	3	90.37	61.98	1.51	8.69	6.10	4.93	10.58	0.62
20.9.....	1	90.44	64.39	5.28	8.65	4.42	4.41	9.46	1.52
26.2.....	2	88.69	65.07	2.34	9.80	6.95	4.53	9.64	1.68
26.3.....	3	87.05	62.34	1.87	10.47	6.29	5.13	10.04	3.86
33.6.....	1	90.39	68.03	4.45	7.43	4.28	4.16	7.62	4.05
33.5.....	2	91.63	66.02	2.70	8.23	5.54	4.85	8.64	4.03
38.7.....	1	92.30	71.17	6.13	7.15	4.10	3.61	6.81	1.89
39.5.....	1	93.26	75.52	6.17	5.88	3.26	3.48	6.08	1.57
40.0.....	2	89.19	68.59	2.70	8.35	5.36	4.43	8.26	2.31
40.4.....	3	88.95	65.29	1.55	9.34	6.66	5.28	9.57	2.31
44.5.....	1	90.40	72.25	6.97	5.87	3.55	3.33	6.35	1.69
44.6.....	2	87.68	68.76	2.56	8.90	5.91	4.44	8.25	.89
44.7.....	3	89.01	67.80	2.54	9.61	5.22	4.67	8.67	1.05
47.0.....	1	92.24	74.76	4.74	6.15	3.75	3.52	5.81	1.47
47.7.....	2	90.12	68.58	3.53	8.36	5.23	4.90	8.18	1.19
47.9.....	3	89.09	66.63	3.17	8.81	5.59	5.22	9.07	1.62

¹ Warm empty weight equals the difference between the live weight and the weight of the contents of the stomach, intestine, and urinary bladder.

The lower planes of nutrition markedly affected the development of the stomach and liver, so that with the latter there was a rather steady decrease in proportion from birth to 4 years of age as compared in the full-fed steers with a rather steady increase to 8½ months of age, followed by a decrease from that time on. Many changes in the relationship of parts occurred at about 8½ months of age. Interesting tables and graphs are given which show the proportions of lean, fat, and bone in the empty animal, the carcass, and in different parts of the animal, with special reference to the wholesale cuts.

From 3 months to 4 years of age the carcasses from the group receiving the full feed decreased in the percentage of skeleton and lean flesh from 25 to 10 per cent and 67 to 42 per cent, respectively, whereas the fatty tissue increased from 6 to nearly 48 per cent. In group 2 the skeleton decreased from 28 per cent of the carcass to 18 per cent, the lean flesh decreased from 66 to 58 per cent, and the fatty tissue increased from 5 to 22 per cent. In group 3 the skeleton decreased from 27 to 20 per cent, while the lean increased from 67 to 70 per cent at 18½ months, with a decrease again to 66 per cent. The fat increased from 3 to 12 per cent.

The proportions of the carcass which consisted of loin, rump, flank, and plate increased with age and fatness, while the proportions of round, chuck, neck, and shank decreased with age. The relationship of parts at birth are also given for comparison as previously reported (E. S. R., 45, p. 67).

Studies in animal nutrition.—III, Changes in chemical composition on different planes of nutrition, C. R. MOULTON, P. F. TROWBRIDGE, and L. D. HAIGH (*Missouri Sta. Research Bul. 55* (1922), pp. 3–38, figs. 20).—In continuing the above study, the different organs and parts of the animals on which the changes in proportions of carcass and offal were studied were analyzed for their content of water, fat, nitrogen, ash, and phosphorus. The composition of the total beef animal was also determined on an analytical, empty, and fat-free (protoplasmic) basis.

In the total animal the water content was found to decrease with the higher planes of nutrition and with increased age, whereas the fat increased under the same conditions. The nitrogen content increased slightly to 3 months of age, after which it remained rather constant for groups 2 and 3, but decreased for the animals that were full fed. The ash content in particular and the phosphorus content in general increased slightly from birth to 4 years for the animals in groups 2 and 3, but for the full-fed steers slight increases occurred to 3 months, followed by slight decreases to 5½ months, after which they remained rather constant to 3 years, followed by a rapid decrease.

The composition of the blood, liver, spleen, and kidneys was found to remain fairly constant for animals of the different ages and on different planes of nutrition. The percentage of fat increased and the water decreased in the lean and fat flesh with age and increased fatness. The nitrogen, ash, and phosphorus contents were found to decrease with increased age and fatness, especially in the case of the full-fed steers. The composition of the skeleton was found to be rather constant in nitrogen, but the phosphorus, ash, and fat greatly increased with age, whereas the water decreased.

Using the analyses of embryos and calves at birth previously noted (E. S. R., 45, p. 67), graphs have been constructed showing the analyses of beef animals on a fat-free basis from conception to 4 years of age. Calculations of the composition of the gains made showed that for the full-fed steers the gains became richer in fat, with a decrease in the other constituents, with advancing age until the last gains are shown to consist of 90 per cent fat. Groups 2 and 3 show some variation in this respect. An extensive series of tables gives the data in detail.

Investigations in the growth of cattle, A. SCHMID (*Landw. Jahrb. Schweiz.* 36 (1922), No. 3, pp. 311–403, figs. 33).—Curves and data are presented showing the changes which occurred during growth in seven Simmental cows as determined by weights and a vast number of measurements taken at 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 18, 24, 36, 48, 60, and 72 months of age.

Beef production in Colorado, C. I. BRAY (*Colo. Agr. Col. Ext. [Bul.] 190A* (1922), pp. 40, figs. 18).—This is a discussion of the general principles of beef management as practiced in Colorado, with brief discussions of the more common diseases of beef cattle.

The cattle-raising industry of the Southwest, C. C. LINCOLN (*Los Angeles: Security Trust & Savings Bank, 1921, pp. 24, figs. 6*).—This is a discussion of the economic conditions of the cattle industry in the Southwest, with special reference to the States of California, Arizona, and Nevada.

Practical sheep husbandry, W. A. BURNS (*Chicago: Author, 1919, pp. 84, figs. 44*).—This book gives practical instructions for the feeding, management, and breeding of sheep, as well as directions for preparing mutton and lamb for table use.

Sheep raising in Georgia, C. E. KELLOGG and H. V. PERSELLS (*Ga. Agr. Col. Bul. 259* (1922), pp. 32, figs. 16).—Directions for the care, management, and feeding of sheep are given, with special reference to Georgia conditions.

Care and management of sheep on the farm, W. E. JOSEPH (*Montana Sta. Circ.* 105 (1922), pp. 29, figs. 12).—A discussion is given of the practical methods of feeding, breeding, and caring for the foreign flock. The management and feeding of the lambs are also taken up. The grades of wool are described, as well as information on how to prepare the fleece for market.

Summary of two years' data on production of early spring lambs, C. A. WILSON (*Tenn. Agr. Col. Ext. Pub.* 109 (1922), pp. 2).—A brief summary of two years' experiments in the production of lambs is given, in which it has been found that maximum production has been obtained from ewes 4 to 6 years of age, and that the grade ewes in good condition were more efficient than scrub ewes in thin condition at the beginning of the breeding season.

Statistical review of the wool and wool textile trades, 1912-1921, compiled and edited by W. H. DEAN (*London: H. Dawson & Co., 1922, pp. XII+104, pls. 4*).—This consists of series of tables giving data on the wool production and commerce in wool in the United Kingdom, France, Germany, the United States, Japan, Australia, New Zealand, South Africa, and South America.

The progress of metabolism after food in swine, J. W. CAPSTICK and T. B. WOOD (*Roy. Soc. [London], Proc., Ser. B*, 94 (1922), No. B 656, pp. 35-49, figs. 3).—The results of a study of the metabolism of a fasting barrow at rest, determined in the calorimeter previously described (*E. S. R.*, 47, p. 865), are reported. Records were kept during six observation periods of 4 to 6 days' duration extending over a period of 114 days. The calorimeter was held at different temperatures during the tests, varying from 10.3° C. to 20.4°.

It was found to require about four days' fasting for the hog to reach basal metabolism. The curves of resting metabolism were uniform in nearly all cases and it was found that the exponential equation

$$\log y + kt = c$$

would fit the curve to a high degree of approximation where y is the metabolism at time t . From the beginning to the end of these tests the hog increased in weight from 220 to 342 lbs.

Feeds and feeding of swine, N. ATHANASSOF (*As Forragens e a Alimentação dos Suínos*. São Paulo: Sec. Agr., Com. e Obras Pub. Estado São Paulo, Serv. Pub. e Biblioth., 1920, pp. 112, pls. 16).—This work deals with the composition and digestibility of the different green feeds, grains, roots, roughages, and by-products used for swine feeding, together with suggestions on rations and methods of feeding and fattening swine.

Swine feeding, J. W. WUCHET (*Ohio Agr. Col. Ext. Bul.*, 18 (1922-23), No. 1, pp. 16, figs. 2).—The principles of balancing rations for swine are discussed, and methods of feeding are given, with suggested rations for pigs of different ages.

Soy bean and mineral supplements for fattening hogs, C. M. VESTAL (*Swine World*, 10 (1922), No. 3, pp. 18, 19).—Experiments carried on at the Indiana Experiment Station indicate that soy beans with adequate minerals compare favorably with tankage as a supplement to corn for fattening hogs. Average daily gains of 1.77, 1.58, and 1.43 lbs. per head were made by lots of hogs receiving respective rations of corn and tankage, corn and soy bean oil meal, and corn and soy beans as compared with daily gains of 1.83, 1.70, and 1.64 lbs. by hogs receiving the same rations with the addition of a mineral mixture of 15 parts wood ashes, 5 parts 16 per cent acid phosphate, and 1 part common salt.

Other lots of hogs on rations of corn and soy beans supplemented with minerals consisting of 10 parts wood ashes, 10 parts 16 per cent acid phosphate,

and 1 part salt; wood ashes and 16 per cent acid phosphate; wood ashes; 16 per cent acid phosphate; and 10 parts 16 per cent acid phosphate, 10 parts pulverized limestone, and 1 part salt made respective daily gains per head of 1.85, 1.56, 1.64, 1.66, and 1.74 lbs. The last lot produced the cheapest gains, which were calculated at \$4.09 per 100 lbs. The average daily gain of 1.85 lbs. was made at a cost of \$4.14 per 100 lbs., as compared with costs of \$4.26 and \$4.22 for the lots receiving corn and tankage, with and without minerals.

Principles of pork production, D. A. JAY and B. W. FAIRBANKS (*Colo. Agr. Col. Ext. [Bul.] 194A (1922), pp. 19, figs. 11*).—General instructions are given for the management and care of swine.

Pork on the farm, J. A. SIMMS and M. E. DAKIN (*Conn. Agr. Col. Ext. Bul. 44 (1921), pp. 23, figs. 6*).—The methods of killing, dressing, and curing pork on the farm are described.

Hog marketing suggestions, A. L. WARD (*Tex. Agr. Col. Ext. Bul. C-20 (1922), pp. 3*).—A list of grades of hogs and market terms are given, as well as suggestions for loading and shipping hogs cooperatively.

Hybridization in the origin of the races of domestic poultry, A. GHIGI (*Genetica [The Hague], 4 (1922), No. 3-4, pp. 364-374*).—This is a discussion of the possible part played by hybrids in originating new races of poultry.

How to select a good flock, P. C. JAMIESON (*Colo. Agr. Col. Ext. [Bul.] 189A (1922), pp. 15, figs. 18*).—Practical instructions are given in culling and selecting the flock.

Poultry management at New Hampshire College, A. W. RICHARDSON and P. I. FITTS (*N. H. Agr. Col. Ext. Bul. 18 (1922), pp. 32, figs. 6*).—The method of handling and feeding the different classes of poultry at the New Hampshire College is described.

Poultry raising in South Carolina, N. R. MEHRHOF (*Clemson Agr. Col. S. C., Ext. Bul. 53 (1922), pp. 68, figs. 29*).—This publication deals with breeds of poultry, poultry house construction, methods of incubation and brooding, care of the growing stock, feeding, killing, dressing, breeding, management, and marketing of poultry and poultry products.

Brooding and rearing chicks, J. C. GRAHAM (*Mass. Agr. Col. Ext. Leaflet 63 [1922], pp. 20, figs. 3*).—Methods of brooding, housing, rearing, and feeding chicks are given.

The influence of the ration fed to growing chickens on the later egg production of the females.—Preliminary report, H. ATWOOD (*Poultry Sci., 1 (1922), No. 6, pp. 177-185*).—A study of the effects of feeding two lots of pedigreed chicks on the same grain ration, with skim milk in addition to one lot, at the West Virginia Experiment Station, indicates that pullets in the lot receiving skim milk consumed more grain, made more rapid gains in weight, started laying earlier, and laid more and slightly heavier eggs, at least during the first laying year.

Canadian record of performance "A" for poultry, R. W. ZAVITZ (*Poultry Sci., 1 (1922), No. 6, pp. 203-206*).—The Canadian record of performance "A" for poultry consists of trap nest records kept by each owner on his own birds. The flocks entered are subject to official monthly inspection by representatives of the Department of Agriculture. Certificates are issued for each bird laying over 150 eggs per year and advance certificates for over 225 eggs.

The correlation between monthly and annual egg production in the pullet year in the White Wyandotte fowl, J. A. HARRIS (*Poultry Sci., 1 (1922), No. 6, pp. 196-202, figs. 3*).—The monthly and yearly egg records for the first year's production of the 670 White Wyandottes entered in the first nine Storrs International Egg-Laying Contests were statistically treated with results similar to those obtained for White Leghorns (*E. S. R., 47, p. 672*).

The winter cycle in the fowl, J. A. HARRIS and H. R. LEWIS (*Science*, 56 (1922), No. 1443, pp. 230, 231).—In further treating the data previously noted (E. S. R., 47, p. 672) showing the correlation between the seasonal egg production of the first and second years, the authors conclude that there is no evidence to indicate that in White Leghorns, at least, special factors exist which control winter egg production as distinguished from production during any other period of the year.

The incubation of hen's eggs, A. G. PHILIPS and F. D. BROOKS (*Purdue Agr. Ext. Bul.* 101 (1922), pp. 12, figs. 7).—Methods are suggested to help reduce losses of chicks hatched on Indiana farms, which include directions for selecting the stock, setting the eggs, and care and operation of the incubator.

Natural and artificial incubation, B. F. KAUFF (*N. C. Agr. Col. Ext. Ctro.* 130 (1922), pp. 6, fig. 1).—A discussion is given of the methods used in selecting eggs for hatching, and directions for setting a hen and running an incubator.

Overcoming soil contamination in poultry yards, W. T. JOHNSON (*Western Washington Sta. Bimo. Bul.*, 10 (1923), No. 5, pp. 105-109).—This discusses the desirable type of soil for poultry yards in which young chicks are raised. Where the same yard is used year after year, it is suggested that 2 or 3 in. of the top soil be removed, the remaining soil be thoroughly disinfected with lime, and 2 or 3 in. of fresh sand or gravel be spread on the top.

DAIRY FARMING—DAIRYING.

Dietary factors influencing calcium assimilation.—III, The comparative efficiency of timothy hay, alfalfa hay, and timothy hay plus calcium phosphate (steamed bone meal) in maintaining calcium and phosphorus equilibrium in milking cows, E. B. HART, H. STEENBOCK, C. A. HOPPERT, R. M. BETHKE, and G. C. HUMPHREY (*Jour. Biol. Chem.*, 54 (1922), No. 1, pp. 75-89).—In continuation of the study previously noted (E. S. R., 47, p. 875), 3 cows were fed for three periods, of 4, 4, and 5 weeks each on rations similar to those used in the previous experiment. Timothy hay was used in the first and third periods, whereas alfalfa hay cured in the windrow and exposed to the air and sunlight 4 days replaced the timothy hay in the second period. In the third period approximately 200 mg. of steamed bone meal was also given each animal daily. The calcium and phosphorus balances were determined as follows:

Calcium and phosphorus balances maintained on rations including timothy hay, alfalfa hay, or timothy hay and steamed bone meal.

Period.	Week.	Cow 1.			Cow 2.			Cow 3.		
		Week-ly milk production.	Daily balance.		Week-ly milk production.	Daily balance.		Week-ly milk production.	Daily balance.	
			Cal-cium.	Phos-phorus.		Cal-cium.	Phos-phorus.		Cal-cium.	Phos-phorus.
		Lbs.	Gm.	Gm.	Lbs.	Gm.	Gm.	Lbs.	Gm.	Gm.
1.....	1	327.2	-30.37	-39.35	164.5	-10.84	-31.57	272.4	-33.24	-40.07
1.....	2	330.6	-23.86	-35.44	158.8	-10.98	-23.40	283.2	-29.71	-35.79
1.....	3	332.6	-19.16	-30.74	166.8	-11.66	-20.28	273.9	-31.22	-40.41
1.....	4	327.3	-25.87	-36.46	155.0	-17.36	-47.21	260.7	-28.67	-35.25
2.....	1	323.7	+19.31	-33.88	153.3	+21.19	-12.92	253.9	+28.52	-16.37
2.....	2	328.4	-7.54	-18.05	165.8	-6.19	-8.77	251.0	-4.36	-0.61
2.....	3	306.4	-2.69	-5.78	156.5	-1.91	-4.69	251.7	-1.78	+ .43
2.....	4	309.1	-16.84	-0.89	164.0	-1.59	-5.13	248.1	-3.78	+1.26
3.....	1	293.1	-9.31	+5.85	143.1	-16.33	+2.45	235.6	-30.51	-44.30
3.....	2	283.8	-25.92	-29.95	139.5	-2.74	-20.58	233.0	-18.53	-47.89
3.....	3	284.7	-22.34	-9.44	128.2	-6.93	-32.47	222.6	-5.88	-25.33
3.....	4	271.4	-11.92	-20.66	109.5	+18.79	+8.28	215.7	-2.61	-15.51
3.....	5	292.9	-13.84	-29.49	113.3	-11.56	-22.49	215.3	-17.11	-9.44

The weights of each cow at the beginning and end of the test were, respectively, 1,284 and 1,166 lbs. for No. 1, 1,185 and 1,096 for No. 2, and 1,119 lbs. at both times for No. 3. As in previous experiments, the negative calcium balances were maintained on timothy hay alone and with steamed bone meal, but when alfalfa hay replaced the timothy hay negative calcium balances were still maintained though at a lower rate. The positive calcium balance during the first week after the change to alfalfa hay is explained as due to the increased intake and the lag in the elimination of calcium. The lack of agreement between the results of this and the previous experiment is attributed to the presence in the cap-cured alfalfa of a vitamin for calcium assimilation which has been destroyed by exposure to air and sunlight.

Interesting results were obtained from the calcium content of the blood, which was determined for the 3 animals as 22.01 to 24.42 mg. per 100 cc. of blood serum at the end of the timothy hay period, 15.65 to 16.34 mg. 4 days after changing to alfalfa hay, 8.79 to 9.91 mg. at the end of the alfalfa period, and 16.1 to 16.75 mg. per 100 cc. of blood serum at the end of the timothy hay plus steamed bone meal period. There was no significant difference in the calcium content of the blood of cows in the regular herd, some of which had been receiving the alfalfa and others the timothy and bone meal rations over long periods. The inorganic phosphorus in the blood of the 3 cows in the experiment was low during the first period, but higher during the second and third periods.

Balancing rations for dairy cows, E. B. FITTS (*Oreg. Agr. Col. Ext. Bul.* 337 (1922), folder).—Practical instructions in feeding for milk production are given, as well as the nutritive value of the more common dairy feeds.

Keeping dairy herd records, J. A. RUDDICK (*Canada Dept. Agr. Pamphlet* 13, n. ser. (1922), pp. 8, fig. 1).—Methods of keeping butter and milk records by dairymen are described. It is suggested that the sampling and weighing of the milk from each cow be done on three days during each month, preferably the 10th, 20th, and 30th.

Studies in milk secretion, X, XI, XIII, J. W. GOWEN (*Abs. in Maine Sta. Bul.* 304 (1921), pp. 349-351, 352, 353).—Abstracts of three papers in the series of studies in milk secretion (*E. S. R.*, 47, p. 176) are given.

X. *The relation between the milk yield of one lactation and the milk yield of a subsequent lactation in Guernsey advanced registry cattle.*—Correlation coefficients calculated for the milk yield of different years for A. R. O. Guernsey cattle varied from 0.462 to 0.811. This was nearly 0.15 higher than similar correlations for cattle in a purebred Jersey herd, and indicated that future milk records of Guernseys could be estimated on the record of one lactation with greater accuracy than future egg records of White Leghorn hens based on month's egg production.

XI. *The relation between the butter fat percentage of one lactation and the butter fat percentage of a subsequent lactation in Guernsey advanced registry cattle.*—The butter fat percentage remains approximately the same for the same cow in different lactations. The coefficient of correlation varied from 0.637 to 0.893. A comparison with records in a purebred Jersey herd indicate that A. R. O. records are a more accurate indication of subsequent performance than the records of all Guernsey cattle. A. R. O. records were several times more valuable for selecting cows for milk yield and butter fat percentage than score-card methods.

XIII. *Relation between the milk yields and butter fat percentages of the 7-day and 365-day tests of Holstein-Friesian advanced registry cattle.*—The coefficients of variation for the 7-day milk yields were found to be less than the

coefficients of variation of 365-day milk yields in Holstein-Friesian advanced registry cattle, but the reverse occurred in the case of the butter fat percentages. The correlations between the following records were significantly high, ranking in the order given: 365-day milk yields and butter fat percentages with those of subsequent lactations, 7-day milk yields and butter fat percentages with those of the 365-day test when the 7-day test was a part of the 365-day test, and the 7-day tests with the 365-day tests when the 7-day test is not a part of the 365-day test.

Disturbances in milk secretion and the natural bacterial content of the udder, G. KOESTLER, W. STECK, and M. RADOSAVLEVITCH (*Creamery and Milk Plant Mo.*, 11 (1922), No. 12, pp. 43, 44, 45).—This is an English summary of the work previously noted (E. S. R., 47, p. 381).

A monograph of the dwarf cattle of Lower Lusatia, A. KÜHNEMANN (*Landw. Jahrb.*, 56 (1922), No. 5, pp. 781–822, figs. 13).—An account is given of the region of Lower Lusatia, and the peculiarities of the people are described with reference to the manner in which they have influenced the development of the cattle. A discussion is given of the probable origin of the dwarf cattle, and measurements of the body parts of 70 animals have been made and presented.

Dairying in Porto Rico, D. W. MAY (*Porto Rico Sta. Bul.* 29 (1922), pp. 19, pls. 4).—This offers a description of the dairy industry in Porto Rico and suggests methods of improvement. Porto Rican cattle are in general rather poor milk producers, and it is suggested that they might be improved by crossing with the standard dairy breeds. The purebreds, however, are subject to tick fever. Very little supplemental feeding is necessary since pasture is available all the year round, and due to the tropical climate dairy barns do not need to be very expensively constructed, though the roof should not only shed water but should also break the heat of the sun.

Tabulated results of comparative tests of the milk and fat produced by Porto Rican cattle showed that the quantity of milk was not only low, but in some cases the fat content went as low as 1 per cent.

Minor equipment for the small dairy, H. E. McNATT (*Western Washington Sta. Bimo. Bul.*, 10 (1923), No. 5, pp. 93–96).—This is a discussion of the minor devices such as milking machines, cream separators, feed carriers, etc., which may be of value in saving labor or feed, bettering the product, or increasing the profits in a small dairy.

Experimental results on cooling and testing cream, H. W. GREGORY (*Butter, Cheese, and Egg Jour.*, 14 (1923), No. 4, pp. 8–12, 29).—This is the account of an experiment carried on at Purdue University to determine the quality of butter made from cream, cooled by different methods, which was kept until the end of each week, and churned.

The most satisfactory method was to cool each lot of cream separately and then put it in with the rest of the cream. Running the warm separated cream directly into the cooled supply was found next best, whereas cream which was not cooled developed high acidity and was very lumpy. This cream did not make good quality butter. Stirring the cooled cream three times a day was also found to improve its butter-making qualities.

Studies were made of the effect on the butter fat test of leaving samples of cream in a hot water bath to eliminate the lumps in order to get a more uniform sample. It was found that holding the samples in an open jar at 135 to 140° F. for 4 to 8 hours increased the fat from 0.5 to 3 per cent. When held at lower temperatures the increases were reduced, and sealing the jars eliminated the error.

Farrington butter test, E. H. FARRINGTON (*N. Y. Prod. Rev. and Amer. Creamery*, 55 (1922), No. 4, pp. 170-173, figs. 9; also *Creamery and Milk Plant Mo.*, 11 (1922), No. 12, pp. 45-47, figs. 9).—This is a description of the Farrington test for fat in butter, which consists of melting the butter to a creamy consistency and weighing out a sample of about 52 cc. in a 56-cc. bottle. It is then warmed to 140° F., centrifuged for about 15 minutes, and again warmed to 140°, after which a few drops of hot water may be added to make the lower line of the fat more distinct. The number of cubic centimeters of fat is multiplied by 0.9 to determine the weight of fat in the butter. The percentage of fat is calculated on the basis of the weight of the sample of butter taken.

Handbook for use in the inspection of whole milk American cheese under the food products inspection law, C. W. FRYHOFFER and R. C. PORTS (*U. S. Dept. Agr., Off. Sec. Circ.* 157 (1923), pp. [2]+16).—This deals with the market standards and grades of American cheese, showing the methods of scoring cheese which are particularly applicable to the inspection of cheese under the food products inspection law (E. S. R., 48, p. 189).

Proportioning mixes made easy, T. D. CUTLER (*Ice Cream Trade Jour.*, 18 (1922), No. 9, pp. 45-50).—An arithmetical method for calculating the ingredients of the ice cream mix is given, which the author states is short, sure, and easy.

VETERINARY MEDICINE.

Report on the operations of the veterinary sanitary service of Paris and the Department of the Seine during the year 1921, H. MARTEL (*Serv. Vét. Sanit. Paris et Dépt. Seine, Rap. Opér.*, 1921, pp. 189, figs. 7).—This is the usual annual report (E. S. R., 46, p. 479) covering the year 1921.

Annual report on the occurrence of infectious diseases of animals in Germany (*Jahresber. Verbr. Tierseuch. Deut. Reiche*, 30 (1915-18), pp. IV+78).—This report, in continuation of those previously noted (E. S. R., 44, p. 577), covers the period from 1915 to 1918, inclusive.

Annual administration reports on the Civil Veterinary Department in Ajmer-Merwara (British Rajputana) for the years 1920-21 and 1921-22, J. H. G. JERROM (*Ajmer-Merwara Civ. Vet. Dept. Ann. Admin. Rpts.* 1920-21, pp. 6; 1921-22, pp. 6).—The reports include data on the occurrence of infectious diseases.

Report of the Civil Veterinary Department, Assam, for the year 1921-22, W. HARRIS (*Assam Civ. Vet. Dept. Rpt.*, 1921-22, pp. 2+15).—This is the usual annual report (E. S. R., 46, p. 276).

Annual administration reports of the Bombay Veterinary College, Glanders and Farcy Department, and Civil Veterinary Department in the Bombay Presidency (including Sind), K. HEWLETT, E. S. FARBROTHER, and J. H. G. JERROM (*Bombay Vet. Col., Glanders and Farcy Dept., and Civil Vet. Dept. Ann. Admin. Rpts.*, 1921-22, pp. 41).—These are the usual annual reports (E. S. R., 46, p. 480).

Annual administration report of the Civil Veterinary Department, Madras Presidency, for 1921-22, F. WARE (*Madras Civ. Vet. Dept. Ann. Admin. Rpt.* 1921-22, pp. 20).—This is the usual annual report (E. S. R., 47, p. 583).

Model by-laws: Slaughterhouses (*London: Min. Health*, 1922, pp. 23).—The text of model by-laws is presented.

Digest of comments on the Pharmacopoeia of the United States of America and on the National Formulary, A. G. DUMÉZ (*Pub. Health Serv. U. S., Hyg. Lab. Bul.* 131 (1922), pp. XXI+410).—This continues for 1920 the series previously noted (E. S. R., 47, p. 483).

Sterility of domestic animals: Etiology and therapeutics, T. OPFERMANN (*Sterilität der Haustiere: Aetiologie und Therapie. Hannover: M. & H. Schaper, 1922, pp. 64, pls. 24*).—This is a small handbook intended for use by practicing veterinarians and students of veterinary medicine.

A report of seven cases of nicotin poisoning, W. D. McNALLY (*Jour. Lab. and Clin. Med.*, 8 (1922), No. 2, pp. 83-85).—A brief history of poisoning is given for seven cases. It is pointed out by the author that poisoning by the alkaloid is increasing due to its more frequent use as an insecticide.

The importance of the respiratory tract in the production of antibodies, W. PFENNINGER (*Ann. Inst. Pasteur*, 35 (1921), No. 4, pp. 237-260, figs. 6).—A report is given of an investigation of the relative merits of the intratracheal method of inoculation suggested by Besredka (*E. S. R.*, 45, p. 279), and the intravenous and the intraperitoneal methods with respect to the production of agglutinins, precipitins, hemolysins, bacteriolysins, and bactericidins, and to the production of active and passive immunity. Rabbits and in a few cases guinea pigs were used as the experimental animals, two animals being used for the intratracheal injection and two for the other methods employed in most cases.

For agglutinin production rabbits were injected in one series of cases with paratyphoid organisms and in another with bovine contagious abortion bacilli, the intravenous and intratracheal routes being used. In the case of the paratyphoid bacilli the same dosage was tolerated better when given intratracheally than intravenously. The agglutinin titer was about the same for both. With the abortion bacilli fewer agglutinins were produced following intratracheal injection than intravenous, but by the use of massive doses in the former case the agglutinin titer could be made equal to that obtained by intravenous injection.

For precipitin production normal horse serum was used. A slightly higher titer resulted following intratracheal than intravenous injection. For the production of hemolysins against red sheep cells intratracheal injection proved as favorable as intravenous. The absorption was slower, thus resulting in less danger of complication.

For testing the formation of bacteriolysins and bactericidins rabbits and guinea pigs were injected with cultures of cholera *Vibrio* with better results by the intratracheal than the intraperitoneal route.

Comparative studies of the immunity acquired by guinea pigs through intratracheal and intraperitoneal injection of paratyphoid and cholera organisms showed that in both cases the intratracheal injections were tolerated better than the intraperitoneal, and a greater degree of immunity was secured. The protective power of the serum of animals immunized by the two methods was also greater in the case of the intratracheal method.

The relationship between *Bacillus abortus* (Bang) and *Micrococcus melitensis*, E. BURNET (*Compt. Rend. Acad. Sci. [Paris]*, 175 (1922), No. 18, pp. 790-793).—From a comparison of two strains of *B. abortus*, a porcine and a bovine, with *M. melitensis*, the author concludes that these organisms are indistinguishable in cultural properties, pathogenicity for guinea pigs, and serological reactions, and that the only means of distinguishing between them is in their pathogenicity for monkeys, *M. melitensis* producing in these animals a sickness strongly resembling undulant fever of man.

Foot-and-mouth disease (*Jour. Jamaica Agr. Soc.*, 26 (1922), No. 11, pp. 594, 595, 599, 600).—In this brief account reference is made to the occurrence of foot-and-mouth disease in parts of the western parishes of Jamaica.

Blood transfusion and foot-and-mouth disease, L. DESLIENS (*Compt. Rend. Soc. Biol. [Paris]*, 87 (1922), No. 31, pp. 976, 977).—Blood transfusion

with citrated whole blood of animals recovered from foot-and-mouth disease is recommended as a much more efficient means of combating the disease than any other methods which depend upon the specific properties of the blood. To obtain the best results the blood should be taken from the eleventh to the eighteenth day after the first appearance of the disease, and the transfusion should be made within 30 or 40 minutes. A dose of 500 cc. is recommended for full-grown animals and from 200 to 250 cc. for calves. The immunity thus established is not of long duration, but is thought to be sufficient to protect animals until the disappearance of the disease in the vicinity.

Hemorrhagic septicemia in England, J. R. BARKER (*Vet. Jour.*, 78 (1922), No. 569, pp. 416-421).—This is a preliminary account of clinical and bacteriological studies of the lesions caused by varieties of *Bacillus bipolaris septicus*, a disease to which scant reference has been made by English writers.

Is shinnery poisoning hemorrhagic septicemia? E. J. FOREMAN (*Vet. Med.*, 17 (1922), No. 11, pp. 689-692).—The resemblance of the symptoms and post-mortem lesions occurring in oak poisoning to those of hemorrhagic septicemia has led to the discussion here presented.

Infection of man by an organism closely allied to *Bacillus suispestifer* (hog cholera), J. MACKENZIE (*Jour. Roy. Army Med. Corps*, 39 (1922), No. 1, pp. 51-58, fig. 1).—The author reports upon a case of infection in man in which the organism isolated by blood culture resembled strains of *B. suispestifer* in its morphology, cultural characteristics, serological reactions, and virulence to animals. The author reports that in a search through the literature he failed to discover a reported case in which a bacillus of like reactions had been isolated from the blood of man.

Malta fever in southwestern United States, with special reference to a recent outbreak in Phoenix, Ariz., G. C. LAKE (*Pub. Health Rpt. [U. S.]*, 37 (1922), No. 47, pp. 2895-2899).—The author reports upon an outbreak of Malta fever in Phoenix, Ariz., during the summer of 1922, it being the first to have occurred in any city in the United States. More than 30 cases were positively diagnosed, and many others are thought to have occurred. The investigations made showed that all but three of the patients had drunk goat's milk supplied from the same dairy, and that the possibility of these three having drunk of this milk also could not be excluded. It is pointed out that the investigations of Gentry and Ferenbaugh (*E. S. R.*, 25, p. 782) have shown that Malta fever has probably existed among goats in Texas for at least 36 years, while the author's investigations have shown it to have existed in Arizona for at least 14 years.

The rat as a disseminator of the relapsing fever of Panama, S. T. DARLING (*Jour. Amer. Med. Assoc.*, 79 (1922), No. 10, pp. 810-812).—After first referring to the experimental demonstration of Bates, Dunn, and St. John that *Ornithodoros talaje* Guer. is the natural transmitting agent of the relapsing fever of Panama (*E. S. R.*, 46, p. 682), the author presents a discussion of the rat and its part in the dispersal of the tick, based upon observations in the Canal Zone.

It is pointed out that, while this tick may feed on man in all three stages of its development, it spends naturally a portion of its life on the house rat and probably on other rats which visit habitations. The rat is susceptible to infection from the causative agent of the relapsing fever of Panama, *Spirochaeta novyi*, and since the nymphs of this tick are capable of transmitting this spirochete from animal to animal, the rat plays a part in its dissemination through the dispersal of the ticks and, presumably, of *S. novyi*.

A note on the transmission of surra by ticks, H. E. CROSS and P. G. PATEL (*Vet. Jour.*, 78 (1922), No. 570, pp. 469-471).—This account has been previously noted from another source (*E. S. R.*, 46, p. 881).

Annual report of the camel specialist for the year 1921-22, H. E. CROSS (*Ann. Rpt. Camel Specialist [Punjab], 1921-22, pp. 2+10*).—This report includes data on camel surra by Cross and Patel, previously noted (*E. S. R.*, 48, p. 179).

Effects of injections of the methyl extract of tubercle bacilli on the evolution of experimental tuberculosis in the guinea pig and the rabbit, L. NÈGRE and A. BOQUET (*Compt. Rend. Soc. Biol. [Paris], 87 (1922), No. 36, pp. 1162, 1163*).—In a further study of the immunizing properties of a methyl extract of tubercle bacilli (*E. S. R.*, 48, p. 280), guinea pigs and rabbits artificially infected with virulent tubercle bacilli were treated with the extract as follows:

Six guinea pigs infected on April 26 by double ocular instillation of 0.5 mg. of virulent bacilli received every 4 days, from May 5 to 20, 1 cc. of the methyl extract in the peritoneal cavity. After an interval of 10 days a second series of six injections was made at the same intervals. While the control guinea pigs died of generalized tuberculosis in the usual length of time, 92, 100, and 101 days after the infection, the treated animals died of intercurrent infections in from 115 to 167 days, with localized lesions in the lungs or spleen. Another lot of 8 guinea pigs received the same treatment but subcutaneously. These died in from 73 to 195 days, 4 with localized lesions and 4 with generalized tuberculosis.

Four rabbits were infected on March 3 by intravenous injection of 0.002 mg. of virulent bovine tubercle bacilli, and received from March 7 to June 2, 21 subcutaneous injections of 2 cc. of the methyl extract. Two control animals died of generalized tuberculosis in 2 months, while the treated animals survived the controls by 1 or 2 months, with limited lesions in the lungs.

It is concluded that the injections of methyl extract of tubercle bacilli exercise a favorable action on the evolution of experimental tuberculosis in the guinea pig and rabbit, manifesting itself in a tendency to a localization of lesions which in the nontreated controls spread rapidly and became generalized in all the organs.

The complement fixation reaction with the Besredka antigen applied to the diagnosis of bovine tuberculosis, BROCC-ROUSSEU, URBAIN, and CAUCHEMEZ (*Compt. Rend. Soc. Biol. [Paris], 87 (1922), No. 26, pp. 502, 503*).—The complement fixation test for tuberculosis applied to the serum of the heart blood of 100 cattle, found on autopsy to be tuberculous, gave from weakly to strongly positive results in 95 cases. The 5 negative results correspond to classified and caseous lesions, and the strongly positive to recent purulent or caseous lesions, including 5 cases of generalized tuberculosis. In no case did there appear to be any correlation between the age of the animal and the intensity of the reaction. A preliminary injection of tuberculin increased to a marked extent the number of antibodies in tuberculous cattle.

Attempts at vaccinating rabbits and guinea pigs against tuberculous infection, A. CALMETTE, L. NÈGRE, and A. BOQUET (*Ann. Inst. Pasteur, 36 (1922), No. 9, pp. 625-631*).—A further study of the possibility of immunizing rabbits and guinea pigs against tuberculosis by the injection of bile-treated tubercle bacilli is reported (*E. S. R.*, 46, p. 581).

The intravenous injection of 20 or 30 mg. of the bile-treated bacilli was found to protect healthy rabbits against an infection proving fatal to the controls in from 50 to 65 days. The organisms thus injected appeared in considerable numbers in all the visceral organs in from 10 to 20 days after the inoculation, to a less extent in the bone marrow and lymphatic glands, and not at all in the kidneys. They gradually disappeared from the various organs in about 2

months, although the tuberculin test was positive at the end of the fourth month. The subcutaneous injection of 2 mg. of the same extract repeated daily for 10 times did not furnish the same protection as the intravenous injection as described.

The extent of protection conferred upon guinea pigs by inoculation of the bile-treated bacilli in various ways was tested by ocular instillation of a drop of an emulsion of virulent tubercle bacilli. In an untreated animal this is said to result invariably in a progressive tuberculous infection with fatal outcome. The only method of inoculation which afforded protection against such infection was the intracardial injection of the bile-treated bacilli in a single dose of from 2 to 5 mg. Of 21 guinea pigs thus inoculated, protection was secured in all but 1 for a period of 6½ months. No advantage was secured by combining the intracardial injection with one or several subcutaneous injections of the extract in 1 or 2 mg. doses, or by repeating the intracardial injection.

It is concluded that in the rabbit and guinea pig a certain degree of immunity against tuberculosis can be acquired by introduction into the blood circulation of avirulent bile-treated tubercle bacilli, but that the immunity thus acquired is of very short duration.

Progress of the work in eradicating tuberculosis in cattle and hogs during the year 1921, H. R. SMITH and H. R. DAVISON (*Chicago Live Stock Exch., Sanitary Com. Rpt. Eradication Tuberculosis, 1921, pp. 15*).—This is a report of the live stock commissioners on activities and progress made in the eradication of tuberculosis in cattle and hogs during the fiscal year ended January 31, 1922.

Further researches into the serological diagnosis of contagious pleuropneumonia of cattle, G. G. HESLOP, (*Roy. Soc. Victoria Proc., 34 (1922), No. 2, pp. 180-195; also in Jour. Compar. Path. and Ther., 35 (1922), No. 1, pp. 1-12*).—This paper reports the results of further research on possible diagnostic methods for contagious pleuropneumonia in cattle, in continuation of an investigation previously noted (*W. S. R., 46, p. 582*).

Attempts to modify the complicated technique of the complement fixation test were unsuccessful. Various new preparations were tested as antigens, but all proved inferior to the alcoholic extract of subepidermal tumor tissue used in the previous experiments.

Agglutination tests with known positive and known negative sera, using the microscopic method with dark ground illumination, gave unsatisfactory results in that after a considerable time both negative and positive sera showed agglutination in the same dilution at the same time. A further study of the macroscopic agglutination test led to the discovery that if the culture to be used with the serum to be tested is an old laboratory strain which has been subjected to repeated cultivation through several generations of subculture at intervals of from 6 to 8 days, agglutination will occur with positive sera in dilutions which give negative results with negative sera. In dilutions as high as 1:80, agglutination may take place also with negative sera but not at any higher dilution. The agglutination reaction takes place very slowly at incubator temperature and is complete only after 48 hours at 37° C. Attempts to hasten the reaction by heating the tubes on a water bath at temperatures between 45 and 55° were not successful, nor did incubation for 48 hours at room temperature give as satisfactory results as incubation for the same time at 37°. To prevent the growth of contaminating microorganisms during the long incubation period, a solution of 0.5 per cent carbolic acid in 0.9 per cent saline solution proved satisfactory.

The sera of 23 animals with pulmonary lesions of contagious pleuropneumonia gave positive agglutination tests by this method, the more acute cases in general having sera of higher agglutination titer than the chronic cases. In most of the acute cases agglutination occurred in dilutions of 1:400 and in all the positive cases in dilutions of 1:133. Similar tests with 18 sera obtained from animals found on post-mortem examinations to be free from lesions of contagious pleuropneumonia gave positive results in dilutions of 1:20 but negative in dilutions as high as 1:100. These results, combined with the fact that the technique of the agglutination test is less complicated than that of the complement fixation test, are considered to speak for the former as the most satisfactory test. This is further confirmed by the discovery that the complement fixation test was also given by the sera of animals affected only with cowpox, while negative agglutination tests were obtained with the same sera.

Onchocerciasis of Queensland cattle, T. H. JOHNSTON (*Roy. Soc. So. Aust. Trans. and Proc.*, 45 (1921), pp. 231-247, figs. 28).—In this paper detailed accounts are given of three distinct species of *Onchocerca* recorded as parasites of Queensland cattle, namely, *O. gibsoni* C. & J., *O. gutturosa* Neum., and *O. lienalis* Sts. Reference is also made to *O. fasciata* R. & H., which infests camels.

Hypoderma crossii n. sp., parasitic in its larval stages in cattle and goats in the Punjab, W. S. PATTON (*Indian Jour. Med. Research*, 10 (1922), No. 2, pp. 573-578, pls. 2, figs. 4).—Under the name *H. crossii*, the author describes and illustrates in pen drawings and colors a new oestrid which occurs in the skins of cattle and goats in the Punjab.

The cause of black disease and its method of transmission, being further studies in a braxy-like disease of sheep, S. DODD (*N. S. Wales Dept. Agr., Sci. Bul.* 21 (1921), pp. 29, figs. 6).—This report of investigations extending over a period of six years has been noted from another source (*E. S. R.*, 45, p. 685).

Bacteriological studies on an epizootic among swine, R. BRUYNOCHE and E. LEYEN (*Ann. Inst. Pasteur*, 35 (1921), No. 4, pp. 261-276).—A brief summary is given of the findings in the bacteriological study of 20 specimens obtained from swine in the course of an epizootic causing many deaths. In 6 of these specimens the bacillus of swine erysipelas was found, in 7 the paratyphoid bacillus, in 1 a nonidentified pathogenic organism, and in 6 various organisms such as staphylococcus, colon bacillus, etc. Experiments conducted with the first three organisms are described briefly. Evidence is presented that the various strains of the swine erysipelas bacillus vary in degree rather than in kind, and that the paratyphoid organism is not identical with *Bacillus suispestifer*.

The principal characteristics of the nonidentified organism are summarized as follows: The organism grows slowly on ordinary agar. On bouillon it produces at first a uniform turbidity and later a sedimentation at the bottom of the tube. No pellicle is formed on the surface. On coagulated serum it grows without peptonizing the medium. Milk is not coagulated. On potato a fine, more or less lustrous coating is formed. The organism does not grow at ordinary temperature, does not liquefy gelatin, and grows best in an aerobic medium. On microscopic examination of cultures of this organism there appear to be several forms, including long bacilli with ends sharply rounded, sometimes occurring alone, but more often in 2's or chains of 3 or 5. There are also large cocci occurring alone or in groups of 2. The organism is very virulent for guinea pigs and much less pathogenic for mice.

A few attempts have been made to vaccinate healthy animals in infected regions with killed cultures of the three organisms described. In one herd in which a number of deaths had occurred, a vaccine prepared from cultures of the paratyphoid and unidentified organisms was given in three injections to all of the animals. Following the second injection, only one death occurred in the herd in which there had been three or four deaths a week previously.

Owing to the fact that it is sometimes difficult to distinguish clinically between swine erysipelas and swine paratyphoid, it is thought that it would be of advantage to use a vaccine prepared from both organisms.

Piroplasmosis of the dog, A. MARTIN and R. LASSERRE (*Vet. Jour.*, 78 (1922), No. 570, pp. 488-492).—A summarized account of this infection.

Bird ailments and accidents and how to treat them, C. ST. JOHN (*London: Cage Birds*, 1919, pp. 118).—This small handbook includes a glossary of terms in common use among bird fanciers (pp. 88-118).

Carbon tetrachlorid in the treatment of hookworm disease: Observations in twenty thousand cases, S. M. LAMBERT (*Jour. Amer. Med. Assoc.*, 79 (1922), No. 25, pp. 2055-2057).—The author finds carbon tetrachlorid to be a vermifuge and vermicide of great potency, giving little discomfort to the patient and admitting of rapid treatment at a low cost.

RURAL ENGINEERING.

Hydraulic diagrams for the discharge of conduits and canals, T. HORTON and C. H. SWAN (*New York and London: McGraw-Hill Book Co., Inc.*, 1922, 3. ed., rev. and enl., pp. 53, figs. 19).—This is the third revised and enlarged edition of this work. It presents a set of diagrams based upon the formula of Ganguillet and Kutter, and is intended for use in the study of such sections of conduits and canals as are commonly employed in sewerage, water supply, water power, and land drainage. The set includes conduits of 10 different types of cross section and canals of rectangular and trapezoidal cross section. The Ganguillet and Kutter formula is discussed and the use of the diagrams explained.

Flow of water through spiral riveted steel pipe, F. W. GREVE and R. R. MARTIN (*Purdue Univ. Engin. Expt. Sta. Bul.* 8 (1921), pp. 32, figs. 11).—The data and results of an investigation upon the flow of water through 4-, 6-, 8-, and 10-in. galvanized spiral riveted steel pipes are presented in this bulletin. In this work an effort was made to determine the variation of the friction loss with velocity for flow both with and against laps, the variation in accuracy of four types of piezometer rings, and the relation of the friction loss to that in cast-iron pipes for like conditions of diameter and velocity.

It was found that the friction loss in galvanized spiral riveted steel pipes does not differ greatly from that in new smooth cast-iron pipes when the flow is with the laps. It is concluded that spiral pipe should be so laid that the flow is with the laps.

It is further concluded that the friction loss may be expressed as $h_f = m(v)^n$, where h_f is the loss due to friction expressed as head in feet of water, v is the true mean velocity in feet per second, and m and n are constants for any given diameter of pipe. The relations of m and n to diameter are readily established, allowing the probable friction loss to be calculated for any size of spiral pipe when experimental data are not available. Sample computations and tables of working data are appended.

Irrigation investigations, G. E. P. SMITH, W. E. CODE, and H. C. SCHWALEN (*Arizona Sta. Rpt.* 1921, pp. 597-600).—These investigations include, among other things, brief descriptions of ground water studies in the Casa Grande

Valley and of studies on the effects of the transpiration of trees on the ground water supply.

Protection and development of lower Colorado River Basin (*U. S. House Represent.*, 67. Cong., 2. Sess., Com. Irrig. Arid Lands, *Hearings on H. R. 11449*, pts. 1-4 (1922), pp. 11+210).—The text of the hearings is given.

The Tempe drainage ditch, A. E. VINSON and C. N. CATLIN (*Arizona Sta. Rpt. 1921*, pp. 559-561).—The results of analyses of monthly samples of water taken from the Tempe drainage ditch during the period from July, 1920, to July, 1921, are presented in tabular form.

Rules and regulations of the Secretary of Agriculture for carrying out the Federal Highway Act (except the provisions thereof relative to forest roads) (*U. S. Dept. Agr., Off. Sec. Circ. 161* (1922), pp. 11+14).—The text of the rules and regulations is presented in this circular. The text of legislation amending the act, passed November 9, 1921, and June 19, 1922, is appended.

The effect of sulphur compounds on cement, J. C. WITT (*Philippine Jour. Sci.*, 21 (1922), No. 4, pp. 357-360).—The results of a 5-year study of the effect of sulphur compounds on the strength of cement are reported.

Concentrations of sodium sulphid not exceeding 1 gm. of sulphur per liter do not seriously affect the tensile strength of cement, and in most cases the strength is increased. With high concentrations the strength is lowered in every case. The maximum loss in strength was found to be 32 per cent with neat cement and 37 per cent with cement mortar. In general the percentage loss in tensile strength of the neat cement mixtures, due to the highest concentration of sulphid, varied with the iron content of the cement. For a 3-year period the presence of as much as 5 per cent of sulphuric anhydrid did not cause any serious loss in strength, and in some instances there was an increase.

The farm tractor in Mason and Berkeley Counties, A. J. DADISMAN, J. H. SHAFFER, and F. D. CORNELL (*West Virginia Sta. Bul. 180* (1922), pp. 12, figs. 4).—Data showing records of tractor operations and cost, obtained by personal visits to 60 farms in two sections of West Virginia on which tractors had been in operation for at least one year, are summarized in this bulletin. Tractors ranging from 8-16 to 12-25 h. p. and designed to pull two 14-in. plows were used almost entirely.

The average cost of operating a tractor was \$7.91 per day, exclusive of operating labor. The tractor plowed 5.84 acres per day with a 2-plow outfit at a cost of approximately \$1.35 per acre, exclusive of labor. It required approximately 2.1 gal. of gasoline or 2.7 gal. of kerosene to plow an acre. Tractor power was a substitute for only a part of the horsepower on the farm. The greatest factor in successful tractor work was an efficient operator. The tractors were operated by farmers, their sons, and hired men, and not by professional operators of tractors. No injurious packing of soil was caused by the wheels of the tractor when the soil was in proper condition to be worked. Tractors which had service stations easily accessible gave the greatest satisfaction. Tractors were used an average of 41.66 days per year.

Scottish tractor trials (*Impl. and Mach. Rev.*, 48 (1922), No. 571, pp. 871-880, figs. 12).—The results of trials of 14 tractors, 26 plows, 11 cultivators, 2 grubbers, 10 harrows, and 3 miscellaneous cultivating devices, conducted by the Highland and Agricultural Society of Scotland, are presented briefly and discussed.

Possibilities of the all-purpose tractor, G. W. IVERSON (*Agr. Engin.*, 3 (1922), No. 9, pp. 147-149, figs. 7).—Data from various sources are summarized

in this article for the purpose of indicating the possibilities of an all-purpose tractor on a Corn Belt farm.

Tests of air cleaners for tractor engines, A. H. HOFFMAN (*Agr. Engin.*, 3 (1922), No. 10, p. 167).—The results of a series of studies conducted at the University of California to determine the dust-separating efficiency, vacuum effect, and maximum motor power of 26 air cleaners for tractor engines, including 8 of the dry type, 9 of the water type, and 9 of the oil type, are reported. The test conditions included (1) normal load, normal speed, and quick dust feed, (2) light load, normal speed, and quick dust feed, and (3) variable speed, variable load, idling, quick pick-up with wide open throttle, and back-firing.

The average efficiencies of all tests by groups indicated that the oil group gave the most uniform results, all above 96 per cent; the water group was next, all results being above 88 per cent; and the dry group was third, with results varying from 42.7 to 99.4 per cent.

The vacuum effect for 150 gm. of dust fed in was found to be below 10 in. of water for 21 of the cleaners. The effect on the power of the engine was negligibly small for the average of each group, and in general was so small for each cleaner tested as to render the results inconclusive.

Factors influencing the design and operation of farm building ventilation systems, M. A. R. KELLEY (*Agr. Engin.*, 3 (1922), No. 9, pp. 150-154).—A preliminary report is presented of investigations conducted to determine the factors which influence the operation and design of farm building ventilating systems.

The tests were started during the early part of December, 1920, and continued through most of February, 1921. The first 7 tests were made during December, 8 during January, and the last 4 in February. Altogether 19 tests were made, 3 in horse barns, 1 in a hog house, 2 in barns with mixed stock, and the remainder in dairy barns. Five tests were made in North Dakota, 1 in South Dakota, 6 in Minnesota, 2 in Massachusetts, and 3 in the Upper and 2 in the Lower Peninsula of Michigan. With one exception all tests were made on systems involving the principles of the King system of ventilation and its various modifications. Three tests were made in barns using windows for intake. Most of the barns were of frame construction with varying degrees of insulation, but 2 tests were made in barns of concrete block walls, 1 in a hollow tile barn, and 2 in barns part frame and part masonry.

No definite relation was established between the velocity of the wind and the effect which it has in the production of draft in a well-designed ventilating system. In barns using wall intakes it was noted that the wind sometimes had a greater effect upon the air going out than upon that coming in. It is believed that the wind produced little if any suctional effect upon the ventilation when the velocity was below 3 miles per hour, and hence during a great part of the time the wind will be ineffective. The design and the position of the intakes were found to influence back-drafting and the velocity at which back-drafting occurs. The lowest wind velocity which produced back-drafting in wall intakes 5 ft. or more in length was 6 miles per hour. Back-drafting in window intakes at a wind velocity of 3 miles per hour was not uncommon.

The limits of ventilation secured by window intakes are shown, and it is stated that no reliance can be placed upon window ventilation. Window intakes also make difficult the control of temperature in the stable. Wind velocity was found to have a greater influence on the amount of ventilation in barns having window intakes than in those with wall intakes.

It is concluded that the maintenance of a desired temperature involves a study of insulation, tightness of construction, amount of air space to be heated

by the animal, and the desired amount of ventilation and the methods used in securing it. The tests indicated that a reasonable temperature can be maintained in a properly designed building and ample ventilation obtained at the same time. This was true even under extreme ranges in temperature. It was further found that under average conditions there is a greater difference between the ceiling and floor temperatures in horse stables than in the dairy section of the same barn, which is attributed to the difference in breathing lines and points at which body heat is given off.

The area of intake openings was found to have an important bearing upon the maintenance of stable temperature, and it was possible in most cases to control the temperature by varying the amount of inlet area. The outtake area usually had a greater influence upon the amount of ventilation secured than did that of the intakes. Openings near the floor in the outtakes appeared more favorable to the maintenance of stable temperature than ceiling openings, especially during cold weather. Storm windows aided in maintaining the stable temperature.

Temperature and percentage of moisture in the outside air were found to have a great influence upon the percentage of moisture in the stable air. While the most desirable percentage of humidity in the stable air has not yet been determined, it is suggested that at a stable temperature of 45° F. a relative humidity of 81 per cent is satisfactory. The tests showed that it is not difficult to obtain this degree of moisture when other conditions are favorable. In the majority of the tests the relative humidity at the ceiling was less than that near the floor.

With but few exceptions, and these under unusual conditions, the amount of measured outgoing air was greater than that of the incoming air. Leakage of air is said to be greater at times of high wind velocities and low temperatures. Other details of the studies are discussed.

It is generally concluded that until further research shall give a more definite unit to use it will be advisable to base designs for ventilating systems in horse barns upon the units suggested by King.

Test of a hog house ventilation system, M. A. R. KELLEY (*Agr. Engin.*, 3 (1922), No. 10, pp. 164-167, figs. 4).—In connection with the above report, the results of a test made in a hog barn in Steele County, Minn., during December, 1920, are presented, to determine additional factors influencing the operation of barn-ventilating systems.

The barn was a 2-story or loft type providing room for storage overhead and adding height to the ventilating flues. The walls of the barn were double boarded with drop siding on the outside, with building paper on both sides of 2 by 6 in. studs, and ceiled on the inside with 6-in. flooring. There were 104 hogs, making a total weight of 26,775 lbs. in the barn.

The data show readings taken approximately every three hours during the day. It was noted that except at 8.40 p. m. the volume of measured air going out was greater than that coming in, indicating leakage of air through doors, walls, and windows. There was considerable change in the amount of incoming air between 8.40 and 11 p. m., due mostly to the influence of the wind, partially to decreased wind pressure, and partially to back-drafting in the intakes. While the wind velocity was about 14 miles per hour, the area of intake openings was decreased at 11 p. m., but the effect on the amount of air going out was small. The amount of air coming in was not reduced in proportion to the reduction of area.

It was possible to secure the same amount of ventilation at 6.05 a. m. with a low wind velocity as at 2.15 a. m. with a higher wind velocity but with a

reduced intake area. This is taken to indicate that good ventilation can be secured during low outside temperatures if the system is operated intelligently.

The average amount of air circulated in this barn was 951 cu. ft. per head per hour, based on 104 hogs of 300 lbs. average weight. Disregarding the leakage, this was in excess of the estimated amount required to offset the carbon dioxid produced, and it is therefore assumed that the air in the barn was reasonably pure. Comparing the conditions existing in this barn with the practices recommended by King, it was found that 16 sq. in. of outtake flue area were provided for each 300-lb. hog in a flue 24 ft. in height, with a difference of approximately 20° between the inside and outside air. Since King recommends a cross-sectional flue area of 22 sq. in. per hog for a flue 20 ft. high with a temperature difference of 10°, the conditions are considered comparable.

The average ceiling temperature obtained in this test was 46.1° F., floor 43.2°, room 44.1°, and outside temperature 24.6°.

Data are given showing the relation between the estimated heat production, the heat losses, and the balance available for maintenance of room temperature. The amount of heat loss by ventilation from 11 p. m. until 8.05 a. m. was decreased. Notwithstanding the fact that the outside temperature dropped, it was possible to hold the temperature of the barn at the same level. At this point the areas of intakes were decreased appreciably, the outtakes remaining open. For this test the lowest number of dilutions per hour was a little more than three. There was an estimated average loss of 52 per cent of the amount of heat generated by the animals through ventilation and a 25.5 per cent loss by radiation. These results are taken to indicate the possibilities of maintaining a reasonably uniform temperature in this barn by regulating the amount of intake openings.

Relation of barn construction to sanitation, C. S. WHITNAH (*Agr. Engin.*, 3 (1922), No. 8, pp. 137-139, figs. 4).—The author points out the difference between the fundamentals in the design of artificially heated and animal heated barns as a basis for computations of heat balances in two typical barns which have been recently tested.

RURAL ECONOMICS AND SOCIOLOGY.

Cost of production and farm organization on 126 farms in North Dakota, 1921, and other economic data, R. E. WILLARD, H. METZGER, and T. S. THORFINNSEN (*North Dakota Sta. Bul.* 165 (1922), pp. 129, figs. 9).—Complete detailed farm and cost records for 1921 were gathered by the farm management department of the station cooperating with the Bureau of Agricultural Economics, U. S. D. A., from 126 farms widely distributed through four geographical sections of North Dakota, the Red River Valley and central, northwestern, and southwestern divisions.

Twenty-two of the farmers were tenants and 104 owners. Wheat occupied 89 per cent of the crop area in the State and was the principal source of income for the State as a whole, although it amounted to only 4 per cent of the income in the southwest where the sale of dairy products is highest. Hay, oats, corn, and barley were next in importance on the 126 farms. Of the farms furnishing records 29 made a profit in 1921, while 97 were operated at a loss. The average net loss of all farms was \$848, representing a net loss of 2.8 per cent on the investment of owner farms.

A summary of costs is given in the following table:

Summary of some of the annual costs on farms in North Dakota, 1921.

Item.	Average.	High.	Low.
Keeping work horses, per head	\$74.00	\$92.12	\$60.48
Operating automobiles.....	¹ 231.00		
Operating tractors, each.....	² 460.00		
Keeping sheep, per ewe.....	³ 6.50		
Keeping cattle, per head.....	79.00	115.00	62.00
Producing wheat, per acre.....	14.09		
Producing wheat, per bushel.....	1.43	13.00	.71
¹ 114 farms	² 49 farms	³ 24 farms.	

Eighty-four per cent of the wheat was produced at \$1.80 per bushel or less. As the yield per acre was increased, the acre cost increased, but the cost per bushel decreased as follows: At 2.5 bu. the cost was \$3.77; at 6.75 bu., \$1.91; at 9.9 bu., \$1.41; at 13 bu., \$1.22; and at 19 bu., \$1.01. The gross income from wheat increased as the size of business increased, and the average net farm loss was much greater on the large farms.

The average work horse was used 78 days at productive work in 1921. As the amount of work increased from 51 days per horse to 112 days, the cost of keeping the horses increased from \$60 to \$93, but the cost per day of work decreased from \$1.18 to 83 cts. This reduction in cost per day of work resulted in a net saving of \$946 per farm.

The value of the food furnished by the farm to the household averaged \$524 per farm, representing 15 per cent of the gross farm income in 1921.

Farmers making sales of dairy products amounting to 18 per cent of their gross income made a net increase in income of \$384 over farms making less than 4 per cent of their gross income from dairy products.

The average power cost of plowing with tractors was \$1.98 per acre and with horses 92 cts. per acre. The farms which operated tractors (49) stood a net loss of \$1,228 each, while those which operated without tractors (73) stood a net loss of \$540 each. The percentage of loss on the investment likewise was greater on farms that operated with tractors than on those without.

Farm costs and farm organization, R. E. WILLARD (*N. Dak. Agr. Col. Ext. Circ. 57* (1923), pp. 8, figs. 2).—The information noted above is presented here in a more condensed and less technical form.

Statistics of rural land holdings for Paraguay [1920], J. V. RAMÍREZ (*Asuncion, Paraguay: Dir. Gen. Estadís., 1921, pp. 33*).—Statistics showing the number and size of holdings by divisions are given on the bases of a national census.

Farm accounts for income tax purposes, A. G. RUSTON (*Yorkshire Agr. Soc. Trans., 79* (1921), pp. 15-33).—The farmer is advised to keep accounts for the sake of knowing his financial standing year by year, the actual profits on each year's operation of the farm, which departments are paying best and which are being run at a loss, and to disclose leakage in expenditures, these considerations being additional to the necessity of being prepared to make income tax returns. A number of examples are quoted of farms for which the accounts were analyzed and suggestions were made as to modifications in organization. Methods of farm valuation are described and illustrated, as is also the keeping of itemized income and expenditures accounts.

Labor on the farm, M. RINGELMANN (*Ann. Inst. Natl. Agron., 2. ser., 16* (1922), pp. 97-160, figs. 24).—Seasonal requirements for work animals and man labor on a farm of about 259 hectares (640 acres) near Plailly in the south-

eastern part of the Department of Oise, France, have been recorded, using the arithmetic average for three years 1911 to 1913, inclusive. Data are tabulated according to operations, including plowing, harrowing, rolling, distributing fertilizers, crop cultivation, harvesting, plowing of stubble, carting, and miscellaneous activities. They are presented also by means of graphic illustrations.

The position of the agricultural laborer in Esthonia, W. MARTNA (*Internatl. Labor Off.*, [Geneva], *Internatl. Labor Rev.*, 5 (1922), No. 5, pp. 731-738).—These pages review legislation regulating the hours, wages, age of employment, and other considerations affecting agricultural labor.

The marketing of Argentina's wheat, C. K. MICHENER (*Northwest. Miller*, 132 (1922), No. 10, pp. 1085, 1086, 1099-1102, figs. 11).—The waterways and railroads of the country, the Government port works, and methods of handling grain cargoes at Buenos Aires are described in detail. Privately owned docks and grain-handling facilities at certain less important ports are also noted. Exports of grain from Argentina in recent years are briefly reviewed.

Weather, Crops, and Markets (*U. S. Dept. Agr., Weather, Crops, and Markets*, 3 (1923), Nos. 1, pp. 16, figs. 2; 2, pp. 17-32, figs. 3; 3, pp. 33-56, figs. 9; 4, pp. 57-80, figs. 6).—The usual weekly notes on weather conditions in certain areas and temperature and precipitation charts for the weeks ended January 2, 9, 16, and 23, 1923, are given in these numbers, together with two special summary articles noted elsewhere (see pp. 417, 418). Statistical reports on market receipts, prices, and the position in the market of important products and classes of crops and live stock are given as usual. The annual certified seed potato crop review for 1921 is found in No. 2. Other annual crop reviews are devoted to cotton and produce, these appearing in No. 3, and the live-stock and meat reviews appearing in No. 4.

The fall of agricultural prices: Its causes and effects, G. E. ROBERTS (*Econ. World*, n. ser., 24 (1922), No. 23, pp. 796-801).—Changes since 1914 in prices of grain and live-stock products are reviewed in detail. It is held that the combined effect of the general policy of inflation was to overdo the use of credit, create an abnormal price level, and bring about a disastrous reaction. Railway rates are said to be too high, especially upon the crude and bulky products, such as those of the farm, in proportion to their market values, but they can not be reduced unless railway operating costs are reduced. The things the farmer has to buy have not come down to correspond with what he has to sell. The lack of speculative interest, the want of courage to buy farm products and carry them for future sale, has been one of the factors in the weakness of the markets.

Inheriting the earth, or the geographical factor in national development, O. D. VON ENGELN (*New York: Macmillan Co.*, 1922, pp. XVI+379).—This is an economic as well as geographic study of the significance of environment in the development of nations. The chapters are the dissimilarity of nations, the land and the people, the nation and the place, the individual and the nation, international anarchy v. international amity, independence or interdependence of nations, inheriting the earth—the Temperate Zones, and the last two which deal with the conquest of the Tropics, being concerned, respectively, with the natural resources of the Tropics and the human factor.

Report to the Governor General of Algeria in awarding farm prizes in the southern region of the Department of Algiers in 1922, P. BERTHAULT (*Bul. Agr. Algérie, Tunisie, Maroc*, 2. ser., 28 (1922), No. 8-9, pp. 209-266, pls. 3).—This describes in detail climatic, geographic, and economic conditions found in this region, the principal crops and live stock, customs of cultivation,

utilization of fertilizers, the choice of varieties and preparation of seeds, and credit facilities. The farm organization and methods found on two farms awarded the first and second prizes for the most successful farm business are set forth. Projects winning special medals and horticultural prizes are similarly noted.

The Saharian oasis of Laghouat, G. MÉNARD (*Ann. Inst. Natl. Agron.*, 2. ser., 16 (1922), pp. 53-96, figs. 7).—This article is descriptive of varieties and methods of producing crops in this locality, the fauna, and domestic animals found there. Certain recommendations for introducing improvements as to water supply, use of fertilizers, methods of cultivation, and commercial relationships are offered on the basis of the author's personal observations.

New agrarian legislation in central Europe (*Internatl. Labor Off.*, [Geneva], *Internatl. Labor Rev.*, 6 (1922), No. 3, pp. 345-363).—In Germany, Austria, and Hungary the position taken by legislators is that, for social reasons, peasant proprietorship is to be encouraged. Land belonging to the State is used for creating small farms, and the breaking up of estates bought from voluntary sellers is facilitated. In Czechoslovakia, Poland, Rumania, and Lithuania, however, maximum areas are being established by law for individual properties, anything beyond which is expropriated by the State. In the first group private activity is explicitly allowed. In the other countries considered it would seem that private activity is forbidden, and State institutions enjoy a monopoly.

Comparisons are made between the policies of the different countries in providing for joint cultivation by societies, national land settlement, the creation of homestead dwellings, and provisions for ex-service men, workers employed on the expropriated estates, other landless inhabitants of rural districts, and former employees in the service of the State.

Enactments bearing on the maintenance of the new agrarian systems established are noted.

Rural community building, W. E. GARNETT (*School and Soc.*, 16 (1922), No. 413, pp. 600-604).—Two principal questions around which community study are held to center are with reference to what constitutes a well-rounded community and whether or not systematically planned community progress is feasible. The term community is said to denote "that area where the majority of the people are definitely conscious of mutual interests and concerns, are in the habit of associating together for common purposes, and have a well-developed spirit of loyalty to a common center and its institutions." The area embraced by and the number of families in a neighborhood are usually smaller than in a true community. A list of 27 ideals for rural communities is drawn up. It is held that community development depends largely upon a comprehensive, well-balanced plan and upon the leaders.

The new and old immigrant on the land, C. L. FRY (*New York: George H. Doran Co.*, pp. XII+13-119, pl. 1, figs. 33).—This belongs to the Town and Country Series being prepared under the direction of E. de S. Brunner, being a study of the field of Americanization awaiting the rural church in Sheboygan and Price Counties, Wis. The first of these is a rich agricultural area, while the latter is still in the pioneer stage. Sheboygan County is a region early settled by Germans of the Lutheran, Reformed, and Evangelical faiths. Out of every hundred inhabitants, 19 are native Europeans and 30 American born of foreign parents; 14 have a foreign-born father or mother, while 37 are native born of American stock. Price County is sparsely populated. The racial groups are unusually varied. On the average 1 man in 4 is foreign born, 2 are born of foreign or mixed parentage, and 1 is of American stock. Social agencies, social

life, and churches of the two counties are contrasted. This material is presented as part 1.

Part 2 contains the methodology and definitions, as well as tabulations of major facts revealed by the investigation.

The country church in colonial counties, M. PATTEN (*New York: George H. Doran Co., 1922, pp. XIV+15-107, pl. 1, figs. 31*).—This is the seventh in the series described above. The history, equipment, and finances; members, services, and church organization; Sunday schools, young people's societies, and community programs of churches in Addison County, Vt., Tompkins County, N. Y., and Warren County, N. Y., have been investigated and evaluated, as are also, though somewhat less in detail, the social agencies found in these areas. The close relationship between economic conditions and folk depletion and abandoned churches in some of the communities is pointed out. Other problems discussed are the social and religious ministration needed by foreigners on the land, the summer-resort population, and the young people. Church federation is discussed as one remedy for the evil of overchurching. Ten steps are suggested which might be worked out by cooperation among the churches of these counties. Appendixes include a description of methods used in the survey and definitions, as well as statistical tables.

Irrigation and religion, E. DES. and M. V. BRUNNER (*New York: George H. Doran Co., 1922, pp. [4]+VIII+9-129, pl. 1, figs. 30*).—Orange and Stanislaus Counties, Calif., are studied in this one of the Town and Country Series.

A high level of intelligence and a large proportion of native-born citizens are noted in these regions. Irrigation is said to have been responsible for the agricultural prosperity and social characteristics, such as well-developed community spirit and cooperative enterprises. Schools, libraries, and voluntary social and religious agencies on the county basis are described, as well as church equipment and finance, ministers, membership, and religious programs.

The Japanese problem is noted and found not to be acute in Orange County, although in Stanislaus County these orientals compete with both farm operators and farm laborers. It is an economic problem with a religious phase which some of the churches are making an effort to meet. Work with other foreign-born groups is noted.

The surveyors give their conclusions and recommendations in the last chapter. Methodology and definitions and statistical tables constitute appendixes.

Proceedings of the Sixth General Assembly of the International Institute of Agriculture, May 8-16, 1922 (*Inst. Internatl. Agr. [Rome], Actes 6. Assemblée Gén., 1922, I, pp. [3]+357, figs. 6; II, pp. XXIII+864*).—The proceedings of meetings and reports of committees are given, including a plan of reorganization of the institute and its various bureaus and detailed reports on the general activities of the statistical service and its publications.

International yearbook of agricultural statistics, 1909 to 1921 (*Inst. Internatl. Agr. [Rome], Ann. Internatl. Statis. Agr., 1909-1921, pp. XCVI+741*).—The data for the three years 1919 to 1921 are collected, with the corresponding figures for the five years of the war 1914 to 1918 and with those of the earlier period 1909 to 1913, although they are not deemed strictly comparable owing to changes in national boundaries that have taken place during the period.

This volume continues the series previously noted (E. S. R., 43, p. 896).

Report on economic and financial conditions in Mexico, 1920-1921, N. KING (*London: [Gt. Brit.] Dept. Overseas Trade, 1921, pp. 34*).—This and the reports following are submitted by British commercial representatives, setting forth the agricultural production, industry, trade, transportation

facilities, and other economic and social conditions in the respective colonies and foreign countries.

Report on the financial and commercial conditions in the Republic of Honduras for the fiscal year ended July 31, 1921, G. LYALL (London: [Gt. Brit.] Dept. Overseas Trade, 1921, pp. 24).—Another of these reports.

Report on economic and financial conditions in the British West Indies, A. W. H. HALL (London: [Gt. Brit.] Dept. Overseas Trade, 1921, pp. 40).—Another of these reports.

Report on the trade and economic conditions of the Canary Islands, T. J. MORRIS (London: [Gt. Brit.] Dept. Overseas Trade, 1921, pp. 29, pl. 1).—Another of these reports.

Report on the industrial and economic situation in Greece, to April, 1922, E. C. D. RAWLINS (London: [Gt. Brit.] Dept. Overseas Trade, 1922, pp. 74).—Another of these reports.

Report on the economic and industrial conditions of the Serb-Croat-Slovene Kingdom, E. M. HARVEY (London: [Gt. Brit.] Dept. Overseas Trade, 1921, pp. 36).—Another of these reports.

Report on the industrial and commercial situation in Austria, O. S. PHILLIPPS (London: [Gt. Brit.] Dept. Overseas Trade, 1921, pp. 56).—Another of these reports.

[**Agricultural statistics for Belgium and the Belgian Kongo**] (*Ann. Statis. Belg. et Congo Belge*, 46 (1922), pts. 1, pp. 76-78; 2, pp. 83, 108-115, 221).—Statistics of land holdings, cooperation, agricultural schools, prices of agricultural products, and numbers of live stock for the period 1914-1918 and for the year 1919 continue annual reports previously noted (E. S. R., 44, p. 294).

Agriculture [in South Africa], G. FETHERSTON (In *Report on the Economic Conditions in South Africa*, July, 1922. London: [Gt. Brit.] Dept. Overseas Trade, 1922, pp. 25-29).—These pages of a report belonging to the series noted above deal principally with the production and export shipments of fruit, and recommend measures for meeting drought conditions.

Report on the trade and commercial prospects of East Africa, W. H. FRANKLIN (London: [Gt. Brit.] Dept. Overseas Trade, 1921, pp. 36, pl. 1).—Another of the reports referred to above.

[**Statistics of land settlement, agriculture, and pastoral pursuits for Australia, 1910-11 to 1920-21**] (*Aust. Bur. Census and Statis., Prod. Bul.* 15 (1922), pp. 9-76).—This summary of production statistics continues information previously noted (E. S. R., 46, p. 197).

[**Agricultural production in New Zealand**], R. W. DALTON (In *Report on Commercial Conditions in the Dominion of New Zealand to July, 1922*. London: [Gt. Brit.] Dept. Overseas Trade, 1922, pp. 9-16).—Production through a number of years of wool, dairy produce, and live stock and meat is presented statistically.

Report on the commercial, industrial, and financial situation in Japan and her dependencies in 1920 and up to June 30, 1921, E. F. CROWE and G. B. SANSOM (London: [Gt. Brit.] Dept. Overseas Trade, 1921, pp. 80).—Another of the reports referred to above.

Report on the commercial, industrial, and financial situation in Japan, 1921 and up to June 30, 1922, E. T. F. CROWE and G. B. SANSOM (London: [Gt. Brit.] Dept. Overseas Trade, 1922, pp. 60).—Another of the reports referred to above.

[**Agriculture and live stock in the Far Eastern Republic**] (In *Trade and Industries of the Far Eastern Republic*. Washington, D. C.: Spec. Deleg. Far

East. Repub., 1922, pp. 42-60).—A statistical survey of agriculture and cattle breeding in this region is presented in these pages.

[**Agricultural statistics for the Dutch Colonies, 1920**] (*Jaarc. Konink. Nederlanden, Koloniën*, 1920, pp. 66-78, 157).—These pages continue statistical information previously noted (*E. S. R.*, 47, p. 96).

AGRICULTURAL EDUCATION.

Rural life and education, E. P. CUBBERLEY (*Boston: Houghton Mifflin Co.*, 1922, [2. ed.] rev. and enl., pp. XV+377, pls. 30, figs. 74).—This is a revision of a book previously noted (*E. S. R.*, 31, p. 193), with the addition of some textual matter and a number of maps and illustrations.

Congress of French agriculture, 1922 (*Cong. Agr. Franç.*, 1922, *Compt. Rend. Trav.*, pp. 376).—The proceedings of the fourth annual congress held by the National Federation of Agricultural Associations for France at Nancy in 1922 are presented here.

Education in Africa, T. J. JONES (*New York: Phelps-Stokes Fund*, 1922, pp. XXVIII+323, pls. 22, figs. 10).—An inquiry, of which this is a report, was carried on throughout West, South, and Equatorial Africa by the African Education Commission under the auspices of the Phelps-Stokes Fund and foreign mission societies of North America and Europe. It was attempted to find out the educational work being done at present, the educational needs of the people and the extent to which they are being met, and to assist in the formation of plans designed to meet these needs. Some pages are devoted to the attempts that have been made along the line of rural community and agricultural education and teacher training.

Report on agricultural and small holdings schools, 1918-19 and 1919-20 ([*Norway*] *Landbr. Direkt. Beret.*, 1918-19, *Tillegg L.*, pp. [818], figs. 31; *Årsberet.*, 1919-20, *Tillegg L.*, pp. [1034], figs. 45).—These annual reports for Norway are made up of signed reports by specialists and division officials, setting forth courses offered, enrollment, and demonstrations carried on at the numerous schools.

State training schools for teachers of small holders, 1918, 1919, and 1920, M. F. NILSEN ([*Norway*] *Landbr. Direkt. Beret.*, *Tillegg K.*, 1918, pp. 102, figs. 31; 1919, pp. 75, figs. 21; 1920, pp. 67, figs. 16).—These supplements to the annual reports of the director of agriculture for Norway make reports upon the faculty, students, equipment, agricultural instruction, farm work, receipts and expenditures of small scale farming teacher training schools.

Home economics education in Norway, 1918, 1919, and 1920 ([*Norway*] *Landbr. Direkt. Beret.*, *Tillegg N.*, 1918, pp. [4]+III+4-76, figs. 5; 1919, pp. [98], figs. 4; *Årsberet.*, *Tillegg N.*, 1920, pp. [4]+III+78).—These are annual reports of State schools in Norway.

[**Reports of the State schools for teachers of home economics for 1919 and 1920**], F. B. TORP ([*Norway*] *Landbr. Direkt. Beret.*, 1919, *Tillegg M.*, pp. 47; *Årsberet.*, 1920, *Tillegg M.*, pp. 19).—These annual reports cover theoretical and practical courses in cooking and household management.

Teaching Federal Board students, R. E. ROBERTS (*Poultry Sci.*, 2 (1922), No. 1, pp. 10-15).—Experiences encountered at Purdue University in teaching poultry husbandry to men whose previous training does not permit them to take regular university work are set forth. The elementary course consists of three recitation periods covering principally breeding, feeding, housing, and marketing, and more briefly incubation and brooding and diseases, and two laboratory hours per week given over to a study of class, breed, and variety

characteristics, judging for egg production, candling and grading eggs, and a study of incubators and brooders. More advanced courses are arranged for, one on house construction being a practice course given during the summer term.

Problem method of teaching poultry, A. G. PHILLIPS (*Poultry Sci.*, 1 (1922), No. 6, pp. 207-214).—A discussion is given of methods of teaching, followed by an outline of questions and problems used with good results in teaching a senior course in poultry at Purdue University.

Status and results of extension work in the Southern States, 1903-1921, W. B. MERCIER (*U. S. Dept. Agr., Dept. Circ.* 248 (1922), pp. 38, figs. 12).—This is the final separate report of extension work in the South. The account of operations and results in 1921 is prefaced with an historical sketch of the beginnings of county demonstration work with men and boys and with girls and women and its growth and development in the South from 1903 up to the date of consolidation of the two offices of extension work, October 1, 1921.

Fundamentals of farming and farm life, E. J. KYLE and A. C. ELLIS (*New York: Charles Scribner's Sons*, 1922, [2. ed.], pp. XXXI+466, figs. 249).—An effort was made to give this textbook on elementary agriculture the accuracy and scholarship of the specialist in agriculture and the organization and pedagogical manner of presentation of the educator familiar with the conditions in rural schools. Lists of suggestive questions, exercises, and problems are provided for each subject.

Live stock and farm mechanics, J. H. GEIERS (*New York: Macmillan Co.*, 1922, p. VIII+393, figs. 178).—Subject matter relating to the use of concrete, road construction, rope tying, farm buildings, farm home conveniences, farm machinery, boys' and girls' clubs, efficient marketing, and other factors essential to success in farming are treated in this book, in addition to material on live stock and the live stock situation in the world.

Clothing club manual, M. C. WHITLOCK and H. M. PHILLIPS (*Illinois Sta. Circ.* 264 (1922), pp. 88, figs. 65).—This has been prepared for the use of members of clothing clubs. It contains a description of and the directions for those construction problems which will be met in making the garments which are listed under the clothing projects in the manual previously noted (E. S. R., 47, p. 798).

Charts for visual instruction in extension work, A. L. E. BLACKSHEAR (*Ga. Agr. Col. Bul.* 262 (1922), pp. 48, figs. 30).—This discussion deals with the use of charts and similar material for visual instruction in extension work. A very considerable number of the illustrations which are presented have to do with food selection, the feeding of children, dairy problems, and related questions. Of special interest is the discussion of chart making for purposes of visual instruction.

MISCELLANEOUS.

Thirty-second Annual Report of Arizona Station, 1921, D. W. WORKING ET AL. (*Arizona Sta. Rpt.* 1921, pp. 541-616, figs. 9).—This contains the organization list, an administrative report on the work and publications of the station, a financial statement for the fiscal year ended June 30, 1921, and departmental reports, the experimental features of which are for the most part abstracted elsewhere in this issue.

Abstracts of papers not included in bulletins, finances, meteorology, index (*Maine Sta. Bul.* 304 (1921), pp. 343-372+XII).—This contains the organization of the stations; abstracts of seven papers previously noted and

of five others abstracted elsewhere in this issue; meteorological observations noted on page 417; a financial statement for the fiscal year ended June 30, 1921; an index to Bulletins 296-304, inclusive, which collectively constitute the thirty-seventh annual report of the station; and announcements as to the work and publications of the station.

Bimonthly Bulletin of the Western Washington Station (*Western Washington Sta. Bimo. Bul.*, 10 (1923), No. 5, pp. 89-112).—In addition to articles abstracted elsewhere in this issue, this number contains brief articles entitled Early Spring Sown Crops, by M. E. McCollam; Final Report on the Third Western Washington Egg-Laying Contest, by Mr. and Mrs. G. R. Shoup; and Dormant Spraying, Selection of Disease-free Berry Plants, and Warning Against the Tree Inoculation Fake, all by A. Frank.

The outline of science, edited by J. A. THOMSON (*New York and London: G. P. Putnam's Sons, 1922, vols. 1, pp. XIX+296, pls. 138, figs. 2; 2, pp. XIV+297-564, pls. 101; 3, pp. XIX+565-864, pls. 126, fig. 1; 4, pp. XV+865-1220, pls. 93*).—This elaborate work, characterized as "a plain story simply told," is intended to popularize science for the average reader. The chapter headings in volume 1 are as follows: The romance of the heavens; the story of evolution; adaptations to environment; the struggle for existence; the ascent of man; evolution going on; the dawn of mind; and foundations of the universe. Volume 2 takes up the wonders of microscopy; the body-machine and its work; how Darwinism stands to-day; natural history, (1) birds; natural history, (2) mammals; natural history, (3) the insect world; and the science of the mind—the new psychology, psycho-analysis. Volume 3 considers psychic science, by O. Lodge; natural history, (4) botany; interrelations of living creatures; biology, by J. S. Huxley; the characteristics of living creatures; the romance of chemistry; the chemist as creator; meteorology; applied science, (1) the marvels of electricity; applied science, (2) wireless telegraphy and telephony; and applied science, (3) flying. In volume 4 the chapters take up bacteria, by E. R. Lankester; the making of the earth and the story of the rocks; the science of the sea; electric and luminous organisms; natural history, (5) the lower vertebrates; the Einstein theory; the biology of the seasons; what science means for man, by O. Lodge; ethnology; the story of domesticated animals; the science of health; and science and modern thought, by Thomson. A special feature of the volume is the 40 colored plates, in addition to several hundred other illustrations.

NOTES.

Florida University and Station.—A study of the value of sulphur in the control of the root knot nematode was begun at the station February 26 by R. L. Trigg, a 1923 graduate of the Mississippi College. This study is undertaken under a scholarship given by the National Research Council and constitutes graduate work for the degree of master of science in the university.

Kansas College and Station.—The State legislature has appropriated \$2,215,288, exclusive of the Smith-Lever offset funds, for the support of the college and station during the biennium beginning July 1. This amount is about \$500,000 less than the appropriation made in 1921, the reduction resulting chiefly from the diminished requests by the college for new buildings. The appropriations for salaries and maintenance, from which most of the State funds for the support of the main station are allotted, were slightly increased. The funds for the four substations were increased from \$66,000 to \$95,288.

Recent enactments by the legislature have transferred from the station to the State board of agriculture the responsibility for the enforcement of the fertilizer, feeding stuffs, and live stock remedy control laws.

Missouri University and Station.—A new beef cattle barn has been completed on the university farm at a cost of \$25,000. This barn will house approximately 100 head of beef cattle, and has storage room for sufficient feed to carry them through the winter.

An incubation and laboratory building has been constructed on the poultry farm. Twenty-seven new colony houses have also been built.

The horticultural building has been named Whitten Hall in honor of the late Dr. J. C. Whitten, a former chairman of the department of horticulture.

The experiment field commonly known as the rotation field has been named Sanborn Field in honor of J. W. Sanborn, one of the early deans of the college of agriculture and directors of the station. This field was laid out by Director Sanborn 34 years ago, and is one of the oldest experimental fields in the United States.

Dr. George Lefevre, professor of zoology since 1899 and chairman of the department, died January 24 at the age of 54 years. In recent years he had worked especially in cytology and genetics, and under the auspices of the station carried on an important investigation of the inheritance of certain coat colors in poultry, the final paper of which was completed for distribution just prior to his death.

Association of Southern Agricultural Workers.—The twenty-fourth annual convention of this association was held at Memphis, Tenn., February 6 to 8, 1923, with about 500 in attendance, including a considerable delegation from the U. S. Department of Agriculture. R. Paine, mayor of Memphis, welcomed the organization as representative of the industry on which the city largely depends for its growth and development. The president of the association, C. A. Mooers of Tennessee, cited the causes for unrest among the rural population, and described the domination of the cotton crop in the social and economic life of the southern farmer. In a review of the accomplishments of experimenters, he pointed out the need for coordination in planning and carrying out research problems.

Cotton production under boll weevil conditions, the central theme of the meeting, was discussed from the viewpoints of the entomologist, the agronomist, the pathologist, the mechanical and the chemical engineers, and the economist. Recommendations intended for the control of the boll weevil in the cotton-growing States were adopted, and a report summarizing the more important facts and opinions on general cotton production under boll weevil conditions was approved. One of the many resolutions adopted concerned the appointment of a committee on correlation to analyze the experimental projects of the several experiment stations with a view to closer coordination, and to cooperate with the Office of Experiment Stations, U. S. Department of Agriculture, to aid in more closely correlating future projects. The inauguration of experiments with lime was suggested on all the major soil types where conclusive tests have not already been conducted. The association also commended the formation of the cotton council within the U. S. Department of Agriculture, and indorsed the prospective establishment of a boll weevil experiment station in South Carolina by the Bureau of Entomology, in cooperation with Clemson College.

The program also provided for sectional meetings, which comprised the soils and crops section including a pasture and a nitrogen conference, the animal husbandry and live stock section, the extension section, and the horticulture section. Meetings were also held of the Phytopathological Society, Cotton States Entomologists, Resident Teachers, and Dairy Science Association.

A conference of the executives and trustees of the State universities and agricultural colleges of the South, held in conjunction with the association, considered plans for a wider and more uniform system of education in the South, and named a committee headed by President H. A. Morgan of Tennessee to prepare a program applicable to the southern cotton territory.

The following officers were elected: President, D. C. Hull, of Mississippi; vice president, J. N. Harper, of Georgia; secretary-treasurer, H. W. Barre, of South Carolina; and an additional member of the executive committee, H. A. Morgan, of Tennessee.

Miscellaneous.—An International Congress for Cattle Breeding is to be held at the Hague August 29 to September 4, 1923. The program is expected to cover a wide field, dealing with both beef and dairy cattle, with technical problems of heredity and nutrition, and with practical questions such as registration, Government assistance, etc. The secretary is H. G. A. Leignes Bakhoven, Leeuwarden, The Netherlands.

The School of Agriculture of Cambridge University has been granted £30,000 by the Development Commissioners to provide a chair of animal pathology. A comprehensive study of the diseases of farm animals is to be prepared, on the approval of which the commissioners contemplate the allotment of about £25,000 for buildings on sites to be provided by the university.

Steps are being taken by the Canadian Society of Technical Agriculturists to establish a number of graduate scholarships in agriculture of \$500 or \$600 each. It is expected that funds will be derived in part by direct contributions from members and others, and in part from the advertising receipts of the society's organ, *Scientific Agriculture*.

It is announced that arrangements have been made for the continuation of the *Sylloge Fungorum* formerly edited by Saccardo. All authors of mycological literature since 1917 are requested to send their publications to the Laboratorio Crittogamica, Pavia, Italy.

EXPERIMENT STATION RECORD.

VOL. 48.

ABSTRACT NUMBER.

No. 6.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Organic syntheses, edited by R. ADAMS ET AL. (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1921, vol. 1, pp. VII+84, figs. 7*).—This is the first of a series of annual publications consisting of methods for the preparation of organic chemicals. The aim of the editorial committee for this series has been to select the most satisfactory method available for each preparation and to give such details of technique as will enable the process to be conducted on a small or large scale. The necessary apparatus is described and, where necessary illustrated, and accompanying each preparation is a bibliography of references to the literature on methods for the production of the substance described. As a check on the selected method each preparation has been tried out independently in at least two laboratories. Many of the preparations in this and the following volume have been described in a publication by Adams et al., previously noted (E. S. R., 46, p. 414).

Organic syntheses, edited by J. B. CONANT ET AL. (*New York: John Wiley & Co., Inc.; London: Chapman & Hall, Ltd., 1922, vol. 2, pp. VIII+100, figs. 3*).—This is the second volume in the series noted above.

Progress toward the artificial synthesis of carbohydrates and proteins, R. W. THATCHER (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 12, pp. 1146, 1147).—A brief review and discussion of recent investigations on the photo-synthesis of carbohydrates and proteins.

Characteristic proteins in high and low protein corn, M. F. SHOWALTER and R. H. CARR (*Jour. Amer. Chem. Soc.*, 44 (1922), No. 9, pp. 2019-2023).—A study is reported of the relative abundance of the different proteins in high and in low nitrogen corn and the respective monamino and diamino acid content.

The data reported indicate that a considerably larger part of the protein is present as zein and globulins in high nitrogen than in low nitrogen corn, these being formed at the expense of the amids. albumin, and glutenin. The percentage of zein varied from 57.24 in high nitrogen popcorn to 31.85 in low nitrogen corn. The embryo makes up about 15 per cent of the total weight of the kernels of the high nitrogen corn, while dent corn of the usual composition has only about 11 per cent of embryo.

The nitrogen distribution in samples of high and low nitrogen corn, determined according to the Van Slyke method, is as follows: Ammonia nitrogen 5.46 and 5.26, Melanin N 8.14 and 12.07, diamino acid N 16.72 and 8.28, total N in filtrate from bases 71.76 and 76.63, amino N in filtrate 54.27 and 49.31, and nonamino N in filtrate 17.49 and 27.32 per cent.

A new method for sterilizing proteins and other colloidal compounds without denaturization, C. A. MILLS (*Jour. Lab. and Clin. Med.*, 8 (1922), No. 2, pp. 134-136).—The method described depends upon the precipitation of the protein by the addition of sufficient mercuric chlorid to destroy all spores and organisms, the subsequent decomposition of the mercury-protein precipitate by the addition of sufficient sterile sodium chlorid solution to make a 12 per cent concentration, and the dialysis of the soluble double salt in parchment cups with copper shavings in the water in the outer cup to amalgamate with the mercury as it comes out and thus render the process irreversible.

The relationship between fat constants, J. LUND (*Ztschr. Untersuch. Nahr. u. Genussmittel*, 44 (1922), No. 3, pp. 113-187).—This is the report, with analytical data, of an exhaustive study of the complex relationships existing between the various physical and chemical constants of fats and fatty acids.

Enzym action in the light of modern theories of catalysis, E. F. ARMSTRONG (*Jour. Soc. Chem. Indust.*, 41 (1922), No. 8, pp. 110 T-113 T).—A general discussion.

Lime-sulphur concentrate, E. H. SIEGLER and A. M. DANIELS (*U. S. Dept. Agr., Farmers' Bul.* 1285 (1922), pp. 1-11, figs. 2).—Following a brief discussion of the various uses of lime-sulphur sprays, directions are given for the home manufacture, storage, and dilution for spraying purposes of lime-sulphur concentrates. Specifications for the lime-sulphur cooking plants are reported on page 591.

A filtration apparatus designed for use with membrane filters, G. JANDER (*Ztschr. Angew. Chem.*, 35 (1922), No. 103, *Wirtschaft. Teil*, pp. 721, 722, fig. 1).—A description is given, with illustrative diagrams, of an apparatus to be used with the membrane filters previously described (*E. S. R.*, 47, p. 712).

A colorimeter for bicolorimetric work, V. C. MYERS (*Jour. Biol. Chem.*, 54 (1922), No. 4, pp. 675-682, figs. 4).—The colorimeter described employs the same principles as that of Barnett and Barnett (*E. S. R.*, 45, p. 411) and of Gillespie (*E. S. R.*, 46, p. 110) in that two color standards are used. In the present instance the standards are carried in individually movable wedges.

The instrument, which is essentially a modified Hellige colorimeter, consists of a brass box with a heavy metal base and containing a rack and pinion arrangement for three wedges, 100 mm. adjustable scales which emerge from the top of the instrument as the wedges are raised, an eyepiece containing magnifying lens, and prisms of the Duboscq type. The unknown solution is carried in a small glass cup mounted in a door at the side of the instrument. A milk glass plate in back allows for the entrance of light, or a small lamp box may be used instead. With one wedge the instrument may be used for ordinary colorimetric work, with two wedges for bicolorimetric work such as pH determinations, and if the solution is slightly turbid or colored the third wedge may be used to overcome this difficulty. Photographic illustrations are given of the colorimeter, together with data on the accuracy which may be obtained with it and a discussion of the various uses to which it may be put.

A rapid method of determining ammonia in ammonium salts, H. BURKARDT (*Chem. Ztg.*, 46 (1922), No. 125, p. 949).—The method described depends upon the reaction between formaldehyde and ammonium salts as illustrated by the following equation:



The acid set free in this reaction is titrated with standard sodium hydroxid, with phenolphthalein as indicator. The formalin solution should first be neutralized to phenolphthalein and the base standardized against methyl orange.

The determination of phosphoric acid in fertilizers, J. C. VOGEL (*Jour. Soc. Chem. Indust.*, 41 (1922), No. 8, pp. 127 T–129 T; also in *Jour. So. African Chem. Inst.*, 5 (1922), No. 2, pp. 16–23).—This paper includes the report of a comparison of several methods of determining P_2O_5 in fertilizers, including the official method of the Department of Agriculture of the Union of South Africa, the method of Woy involving the precipitation of P_2O_5 as ammonium phosphomolybdate and its ignition and weighing as phosphomolybdic anhydride containing 3.946 per cent of P_2O_5 , the method described by Marchand (*E. S. R.*, 41, p. 411), and a slight modification of this method in which the precipitation is conducted on the water bath. In addition a rapid method is described for determining the water-soluble phosphoric acid in superphosphates by direct titration of the acid calcium phosphate with a saturated solution of lime water standardized against $N/20$ HCl with phenolphthalein. While the figures obtained by this method are slightly low, the results are thought to agree with the actual percentage of P_2O_5 sufficiently well to warrant its use when great accuracy is not required, as in the analysis of samples of a superphosphate fertilizer drawn from a mixing machine.

The determination of aluminum as phosphate, G. E. F. LUNDELL and H. B. KNOWLES (*Jour. Indust. and Engin. Chem.*, 14 (1922), No. 12, pp. 1136, 1137).—Determinations of aluminum as phosphate by various methods are reported, the results of which indicate that “acceptable determinations are possible when only a few milligrams of aluminum are involved, and high values are the rule when more than 1 to 5 mg. of aluminum are precipitated by ordinary procedures. Immoderate washing of the precipitate or the use of a weak acid wash leads to low values, as does also precipitation with only a moderate excess of the precipitant or precipitation in alkaline solution. Under these conditions iron behaves like aluminum, while titanium invariably yields low values.”

The diagnosis of proteins and their derivatives by color reactions, M. A. RAKUSIN (*Biochem. Ztschr.*, 130 (1922), No. 1–3, pp. 268–281).—This is a discussion of the significance of various color tests for proteins.

The microscopical detection of tryptophan in plants, F. KRETZ (*Biochem. Ztschr.*, 130 (1922), No. 1–3, pp. 86–98).—An application of the Voisenet color reaction for tryptophan, as employed by Fürth (*E. S. R.*, 45, p. 311), has been made to the detection of this protein in localized plant tissue. The section is first fixed in formaldehyde or mercuric chloride solution, and is then suspended for from 3 to 5 seconds in a 1:10 aqueous solution of sodium silicate, washed for 1 or 2 seconds in distilled water, and then suspended for 10 or 15 minutes in the Voisenet reagent, after which it is placed in a drop of paraffin oil and examined under the microscope. By this test it is said to be possible to detect the presence of tryptophan in molds and algae. In higher plants the embryonic tissues have the largest amount of tryptophan.

Significance of wheat hairs in microscopical examination of flour, G. L. KEENAN (*U. S. Dept. Agr. Bul.* 1130 (1923), pp. 8, figs. 5).—A further study of the possibilities in the grading of wheat flour samples by microscopic count (*E. S. R.*, 48, p. 313) has led to the conclusion that the count of wheat hairs and hair fragments is a more reliable index of the quality of the flour than the count of both bran particles and hairs. The method of preparing and examining the sample is essentially the same as that previously described.

Data reported on 35 break flours and 74 middling flours show a much higher hair count in the former than in the latter. In commercial flours, while there is to be noted a variation in the counts for the different classes due to lack of uniformity in the milling procedure, the average hair count shows a marked difference in the different grades. The average hair count of 61 samples of

patent flour from hard, blended, and soft wheat was 19, of 52 samples of straight flour 40, of 56 samples of clear flour 88, and of 27 samples of low grade flours 140. Similar studies of experimental flours milled under known conditions gave even more consistent and uniform results. The average count of 6 samples of flour of varying percentage extraction corresponding to the different grades of flour was as follows: Seventy per cent patent 13, 90 and 97.5 per cent straight 28 and 30, respectively, 27 per cent clear 49, and 2.5 per cent low grade flour 124.

The diastatic enzymes of wheat flour and their relation to flour strength, L. A. RUMSEY (*Amer. Inst. Baking Bul. 8 (1922), pp. 86, figs. 10*).—This is the first of a series of reports on an extensive investigation of the diastatic enzymes of flour conducted under the cooperation of the American Institute of Baking and the division of agricultural biochemistry of the University of Minnesota. On account of the difficulty in correlating data obtained on different samples of flour, 14 samples of flour milled from authentic samples of wheat representative of different wheat-producing areas of North America were collected and used for the cooperative work of different investigators. The subject matter of this report includes a general introduction to the whole problem, a survey of the literature on diastatic activity, descriptions of the 14 samples used and of the standard baking procedure adopted, and the report with experimental data of a study of the relation of the diastatic enzymes of the wheat flour to flour strength.

The first point investigated was the most suitable method of clarifying the flour-water or malt-water suspension after autolytic digestion before measuring the diastatic power. The sodium tungstate protein precipitant of Folin and Wu proved to be the most satisfactory reagent, in that the liquid could be clarified without filtering and that the reagent inhibited completely diastatic action and did not interfere with the subsequent determination of reducing sugars by the Munson-Walker Official method.

A study of the effect of concentration of the flour and water on diastatic activity in doughs showed that with a ratio of water to flour of less than 1:1 the diastatic action is not complete, but that with increasing dilution above this point the results are in satisfactory agreement.

In a carefully controlled study of the effect of temperature on diastatic activity in flour suspensions, the maximum production of maltose was at a temperature of 63.5° C. (146.3° F.). It is noted, however, that this temperature is never reached in a dough during a normal fermentation and only for a few minutes while baking. The time curves for maltose production in the same flour at different temperatures showed that for ordinary fermentation the rate of maltose production has reached a practically constant value between 2 and 3 hours. The optimum H-ion concentration for the diastatic action of a given sample of flour during digestion at 27° C. was at pH 4.7 to 4.8, a concentration seldom reached during the fermentation of a normal dough.

Determinations by the method of Bailey and Peterson (*E. S. R.*, 46, p. 612) of the buffer values of the various flours gave results in agreement with those reported by these authors, namely, that high-grade flours are buffered less than low grade. No apparent relationship could be noted between the values for buffer action and the corresponding diastatic activity of the flour as determined later.

As the result of these preliminary studies the method finally adopted for determining the relative diastatic power of the 14 samples of flour was as follows: Ten-gm. samples of the flour were transferred to 250-cc. Erlenmeyer flasks, which were placed in a water thermostat at 27°. To each flask was

added 100 cc. of distilled water from a pipette. The flasks were allowed to remain in the thermostat for exactly 60 minutes, with frequent rotation. At the end of this period the contents of the flasks were transferred to a 200-cc. volumetric flask, clarified with sodium tungstate reagent, diluted to volume, centrifuged, and the reducing sugar determined by the Munson-Walker method. As thus determined, the diastatic power of the different samples expressed in milligrams of maltose varied from 804.1 to 34.8. As compared with the baking strength the samples, with the exception of the very low grade flours, showed diastatic powers which were a fairly good index of their general fermentation power. It is pointed out, however, that the quality of the gluten of the flour must be sufficiently high to conserve the value of the diastatic action and make a good loaf possible.

A few measurements are reported on the sugar content and diastatic activity during the course of normal fermentation of doughs prepared in different ways and on the amount of maltose produced by the same amount of malt diastase acting on different starches. The latter data show that gelatinized starch can not be used as a substrate for determining the diastatic power of a malt product for bread making. At the end of the determination the pH value corresponding most closely to that of normal dough was a sample of Merck's soluble starch according to Lintner, used in water suspension without heating.

An extensive bibliography is appended.

The determination of gums in sugar products, H. T. RUFF and J. R. WITHROW (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 12, pp. 1131-1134, figs. 2).—An investigation of various methods of determining gum in sugar products has led to the conclusion that precipitation by ethyl alcohol, followed by acidification with hydrochloric acid, is the most suitable method for rapid control work. A study of the technique of this method has shown that sodium benzoate can be safely used as a preservative, that the concentration of hydrochloric acid can be varied within rather wide limits without affecting the results materially but that the concentration of the alcohol must be kept within close limits, and that methyl alcohol or ethyl alcohol denatured with methyl alcohol can be used in place of ethyl alcohol. A modified technique for the method is described in detail.

The colorimetric estimation of cystin in urine, J. M. LOONEY (*Jour. Biol. Chem.*, 54 (1922), No. 2, pp. 171-175).—The technique is described for the application of the Folin and Looney method for the colorimetric estimation of cystin previously noted (*E. S. R.*, 47, p. 504) to its quantitative determination in urine.

Standard methods for the sampling and analysis of commercial soaps and soap products, A. CAMPBELL ET AL. (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 12, pp. 1159-1163).—This report of the committee on methods of analysis and specifications of commercial soaps and soap products of the American Chemical Society consists of descriptions of methods adopted by the committee as standard, following the discussion and criticisms of the tentative methods previously noted (*E. S. R.*, 41, p. 314).

Color and ash absorption by boneblack and decolorizing carbons, W. D. HORNE (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 12, pp. 1134-1136; also in *Facts About Sugar*, 16 (1923), No. 1, pp. 12, 13, 15).—Experiments on the relative value of boneblack and various decolorizing carbons for sugar refining are reported. These show that boneblack is a much more efficient ash absorbent than the decolorizing carbons, while the latter are more efficient as color absorbents. The problem to achieve in the manufacture of a successful absorbing agent for sugar purification is considered to be the production of a porous mineral foundation overlaid with a highly activated carbon.

[Chemical studies at the California Station] (*California Sta. Rpt. 1922*, pp. 109-112).—According to a summary of experimental work by M. E. Jaffa and MacKay, "the avocado is unique in that the immature fruit may be either cut in half or much smaller divisions, and will ripen in a few days without any appreciable deterioration, if well covered and the air is excluded." Determination of the fat content in 22 samples of new varieties of avocados showed in three varieties 22, 22.83, and 23.71 per cent of fat, respectively, and in two specimens of another variety 29.78 and 31.59 per cent. "The percentages of protein yielded by the new varieties are, comparatively speaking, low."

Several methods of extracting oil were tried by H. Goss and in nearly every case a colorless oil was obtained, "but this was objectionable in that it possessed a bitter, acrid taste. This is developed during the process of extraction, because the avocado itself does not possess this objectionable feature."

Analyses of five samples of almond hulls as to tannin content showed 10 per cent in the Texas variety, 5 per cent in the next highest variety, and less than 1 per cent in Ne Plus Ultra and I. X. L. Canaigre and canaigre dock contained 8.98 and 1.85 per cent, respectively, of tannin.

Seed from the giant cactus (*Cereus giganteus*), used as a cereal substitute in Arizona, contained 5.79 per cent of moisture, 17.46 of protein, 32.36 of fat, 28.46 of crude fiber, 13.32 of nitrogen-free extract, and 2.61 per cent of ash. Analyses are also reported of dates and grape juice.

Dehydration (*California Sta. Rpt. 1922*, pp. 185-187).—Various dehydration investigations have been conducted by A. W. Christie during the past year as follows:

A compilation of statistics has been made on the development of dehydration in the State. During 1921 the following tonnages (fresh weights) were dehydrated: Apples 4,027, apricots 300, grapes 878, peaches 66, pears 102, prunes 7,366, pumpkins 4,357, and miscellaneous 150—a total of 17,246 tons in 62 different establishments.

A comparison of the cost of dehydrating apples in modern dehydraters under control conditions and in kilns has shown that the cost of the former is not appreciably greater than the latter, both averaging from \$10 to \$11 a fresh ton. The quality of the product obtained by dehydration is much better, not only as a result of better drying conditions but of greater care in the selection of the fruit.

A study of methods of dehydrating cherries has shown that the best results are obtained by dipping the cherries for a short time in boiling lye solution as with prunes, following this with 15 minutes' sulphuring for light varieties only, and then dehydrating for 8 hours at a temperature decreasing from 210° F. to 170°. The total shrinkage is said to vary from 3:1 for unpitted Black Tartarian to 5:1 for pitted Royal Anne cherries. The process is particularly suitable for the utilization at canneries or fresh fruit packing houses of cherries which are cracked, overripe, or bruised, but otherwise sound. The dehydrated cherries are said to be of attractive color and flavor.

It has been found that dates containing too much moisture for carton packing may be reduced to the proper moisture content by placing them in an air-blast dehydrater for a few hours at 150°. This treatment is said not to injure the color or flavor of the dates. Treatment at 160° for 30 minutes will destroy all insect life and also prevent subsequent souring.

In the preparation of pumpkin flour by shredding the pumpkin, steam blanching on trays for 5 minutes, dehydrating until crisp, and then grinding to a flour, it has been found that the drying time can be cut down to 6 hours if a finishing temperature of 185° is used in place of the usual practice of from 8 to 15 hours at a temperature of 110-160°.

An extensive investigation of the dehydration of prunes has led to the conclusion that prunes equal or superior in quality to sun-dried may be produced as economically in dehydrators as by sun drying. The most satisfactory method of drying has been to enter the trucks of lye-dipped prunes on slatted trays at the cooler end of the dehydrator (120–140°) and move them toward the hotter temperature, 165°, the whole process requiring 24 hours. A vigorous flow of air (500–800 lineal ft. per minute between trays) at a relative humidity of from 30 to 40 per cent at the highest temperature should be used. The total operating cost of dehydrating a ton of fresh prunes in three typical plants in 1921 is given as \$4.49, \$4.72, and \$3.81, respectively. The first two of these plants had a total capacity of 10 tons per day and the third of 50.

[**Fruit drying studies by the California Station**] (*California Sta. Rpt. 1922, pp. 139, 140*).—It has been found by L. C. Barnard that black and white cherries, loganberries, and strawberries can be dried successfully in the sun, yielding a product which, on soaking over night in water, compares favorably with fresh fruit for the making of pies and jams.

The kind of wood, whether redwood, fir, or yellow pine, has been found to be immaterial for the trays for sun drying.

[**Olive pickling studies at the California Station**] (*California Sta. Rpt. 1922, pp. 181, 182*).—The softening of olives at the stem end during sterilization and the fermentation and softening during pickling, which have caused losses to olive picklers during the past year, have been made the subject of an investigation by W. V. Cruess.

The first trouble was found to be due to incomplete penetration of the lye during pickling. By following carefully the directions given in Bulletin 333 (E. S. R., 46, p. 163) it is thought that this trouble may be avoided. The fermentation and softening during pickling have been found to be due to bacterial action from infected vats, with the formation of gas which causes the olives to float on top of the brine. Factory observations and laboratory tests have shown that the fermentation develops most rapidly at temperatures between 70 and 100° F., while growth does not take place at from 58 to 60°. The fermentation may be prevented by the use of water at 60° or below, or by heating the olives and wash water to 175° for 30 minutes. Olives pickled direct from the trees were found to ferment more readily during washing than olives stored in dilute brine several months before pickling.

[**Fruit products** (*California Sta. Rpt. 1922, pp. 182–185*).—The work of W. V. Cruess and Irish on the preparation of carbonated beverages from fruit juices (E. S. R., 47, p. 613) has been continued. Sirups were prepared from different varieties of grapes, strawberries, blackberries, loganberries, raspberries, and pomegranates, and a fruit punch sirup from red grape sirup, orange juice, and lemon juice. The sirups were prepared from the berries by washing, crushing, heating to 150° F., pressing, filtering, and adding sugar to a density of 20° Balling; from Muscat grapes by crushing, pressing, heating the juice to 160° F., and filtering, and from red wine grapes by crushing, heating to 160°, pressing, and filtering, both juices then being concentrated to 50° Balling in a glass lined vacuum pan; from the pomegranates by cutting them in half, pressing them in a cider press, heating to 160° F., settling, filtering, and adding sugar to give a sirup of 50° Balling. In the filtration wood pulp gave better results from a filter press with infusorial earth.

Some of the sirups were kept in lacquered cans in cold storage at from 0 to 15° F. or at 32°, and others were pasteurized in lacquered cans or bottles and kept at room temperature. The sirups kept at from 0 to 15° showed no

deterioration in color, odor, or flavor. Nearly all at 32° kept in good condition, although a few molded. The pasteurized sirups showed slight deterioration in color and flavor, but produced quite satisfactory beverages.

In making the carbonated beverages 1.5 oz. of sirup was placed in a 7-oz. soda water bottle and carbonated water added to fill the bottle, which was then capped and pasteurized at 150° for 30 minutes, and stored at room temperature. It is said that most of the beverages have retained their color and flavor during the 8 months in which they have been kept in storage.

In experiments to determine the minimum pasteurization temperature that can be safely used for fruit beverages, it was found that a temperature of 150° for 40 minutes was sufficient for carbonated beverages. Noncarbonated juices spoiled through the development of mold spores following pasteurization at 170° for 30 minutes, but by heating the juice to 180° for the same length of time mold did not develop. Increased pressure and increased acidity of the juice were found not to reduce the temperature required for destroying yeasts and molds.

Further studies by Cruess, Irish, and Quick on the use of fruits in candy making have shown that fruit sirups, dried fruits, and fruit jelly can be used very successfully in the preparation of candies. The difficulty experienced in using raisins for candy centers through the frequent fermentation and bursting of the coating can be avoided by further drying of the raisins to less than 16 per cent moisture.

Studies on canned citrus marmalade juice by Cruess and L. Singh have been previously noted from other sources (E. S. R., 47, pp. 509, 614).

METEOROLOGY.

The climates of the continents, W. G. KENDREW (*Oxford: Clarendon Press, 1922, pp. XVI+387, figs. 149*).—This book attempts to describe the actual climates of the countries of the earth, considered regionally, and thus to supply a need not heretofore met completely by any English work. An introductory part deals briefly with climatic statistics, especially those relating to temperature and rainfall, and with pressure and wind systems. Succeeding parts deal more in detail with the main climatic features of the various regions of Africa; Asia, including European Russia; Europe, excluding Russia; North America, excluding Mexico; South and Central America, Mexico, and the West Indies; and Australia and New Zealand. There are numerous references to the effect on man of the climatic conditions described, but little or no consideration of them from the agricultural standpoint.

Influence of cover crops on orchard temperatures, F. D. YOUNG (*U. S. Mo. Weather Rev., 50 (1922), No. 10, pp. 521-526, pl. 1, figs. 6*).—Observations during one frost season in a 6-acre orange grove near Pomona, Calif., one-half of which was in cover crop and the other in clean cultivation, indicated that the cover crop had little effect on the temperature a few feet above the ground. There was no temperature inversion within 5 ft. of the ground over the clean cultivated area.

Similar observations in a grove near Fontana, Calif., are referred to by the editor. The results of these tended "to show that a cover crop increases the frost hazard, although the amount of the increase is so small as to be practically negligible. At a distance of 5 ft. above the ground, the lowering of temperature amounts to less than half a degree F. Also the duration of critical temperatures is not affected to any practical extent regardless of the condition of the surface, whether cropped or clean."

Forecasting minimum temperatures for the cranberry bogs of New Jersey. G. S. BLISS (*U. S. Mo. Weather Rev.*, 50 (1922), No. 10, pp. 529-533, figs. 8).—Observations at Whitesbog, N. J., are briefly reported and discussed, with the general conclusion that a hygrometric formula calculated from data for at least 50 good or fairly good radiation nights and correlated between the bog minima and data from a nearby Weather Bureau station will give fairly accurate and reliable results and is a valuable aid to the forecaster.

The possibility of seasonal forecasting and prospects for rainfall season, 1922-23. C. L. ROBERTSON (*Rhodesia Agr. Jour.*, 19 (1922), No. 6, pp. 648-655, figs. 2).—This article briefly discusses seasonal forecasts of Rhodesian rainfall, based mainly upon deviations from normal of the mean flood height of the Blue Nile at Khartum during the previous August and September, of the mean rainfall of the southwest monsoon rains of India during the previous June to September, and of the rainfall of Rhodesia during the previous four seasons. The resulting prediction is that the mean rainfall over the whole territory will probably be slightly above normal during the season of 1922-23, the mean rainfall in the northern and western portions of Mashonaland being somewhat under normal and that of southern Matabeleland and southeastern Mashonaland above normal.

Monthly Weather Review (*U. S. Mo. Weather Rev.*, 50 (1922), Nos. 9, pp. 453-514, pls. 24, figs. 25; 10, pp. 515-565, pls. 14, figs. 23).—In addition to detailed summaries of meteorological, climatological, and seismological data and weather conditions for September and October, 1922, and bibliographical information, reprints, reviews, abstracts, and minor notes, these numbers contain the following contributions:

No. 9.—The Preparation and Significance of Free-air Pressure Maps for the Central and Eastern United States (illus.), by C. L. Meisinger; J. Bjerknes and H. Solberg on the Life Cycle of Cyclones and the Polar Front Theory of Atmospheric Circulation (illus.), by A. J. Henry; Foot-layer Densities of Snow (illus.), by H. F. Alps; A Simple Snow-density Measurer, by W. W. Korhonen (translation by H. C. Frankenfield); Climatic Phenomena (illus.), by E. N. Munns; The Use of Charts and Graphs in the Study of Climate (illus.), by V. B. Flanders; Dry Months in the United States, by A. J. Henry; Records of Tornadoes in Tennessee, 1808-1921 (illus.), by R. Nunn; The Heavy Rainfall of September 2, 1922, at Washington, D. C., by A. J. Henry; and Sessions of the Meteorological Section of the International Union of Geodesy and Geophysics, Rome, Italy, May 4-9, 1922, by H. H. Kimball.

No. 10.—Progress in Radiation Measurements (illus.), by C. Dorno; Influence of Cover Crops on Orchard Temperatures (illus.), by F. D. Young (see p. 508); Calculating Temperature Extremes in Spokane County, Wash. (illus.), by E. M. Keyser; Forecasting Minimum Temperatures for the Cranberry Bogs of New Jersey (illus.), by G. S. Bliss (see above); A Simple Geometric Deviation of the Laws of Refraction of Light Inclined to a Principal Plane of a Prism (illus.), by W. J. Humphreys; Rare Halo of Abnormal Radius, by A. F. Pilippo; Certain Unusual Halos (illus.), by W. J. Humphreys; On the Lower Oblique Arcs of the Anthelion (illus.), by E. W. Woolard; and Hayford on Effects of Wind and of Barometric Pressure on the Great Lakes, by A. J. Henry.

Ohio weather for the year 1921. W. H. ALEXANDER and C. A. PATTON (*Ohio Sta. Bul.* 360 (1922), pp. 217-312, figs. 63).—Data for temperature, rainfall, snowfall, evaporation, wind, and frostless periods at the experiment station at Wooster, and on temperature and precipitation for the entire State during 1921 and preceding years are recorded and summarized in tables and diagrammatic maps.

The mean temperature for the year at the station was 53.3° F.; for the State 54.6°. The highest temperature at the station was 96°, July 4; for the State 103°, July 4. The lowest temperature at the station was 9°, December 22; for the State 2°, February 1. The annual rainfall at the station was 41.9 in.; for the State, 42.97. The number of rainy days at the station was 149; for the State, 126. The prevailing direction of the wind was southwest at the station and in the State at large. The frostless period at Wooster was 149 days, May 17 to October 13. The total evaporation at Wooster, April to October, 1921, was approximately 31.9 in.

The outstanding meteorological feature of the year "was undoubtedly its persistent warmth. It was easily the warmest year of record (1883-1921), and yet it was singularly free from extremely hot weather."

Other notable features of the weather of the year were (1) a large percentage of sunshine in January, (2) unusually high maxima in February, (3) the warmest March in the last 100 years, (4) heavy rains in March, also in December, in the southern part of the State, (5) possible injury to fruit buds by the cold waves of March 28-29, April 10, 11, and June 4-8, (6) the exceptionally fine harvest weather of September and October, (7) the large amount of cloudiness and the large number and severity of thunderstorms in November, (8) light frost in Shelby, Richland County, on August 15, and (9) the small average snowfall for the year, namely, 16 in., as compared with the normal of 33.7 in.

Annual report of the [Philippine] Weather Bureau, 1919 ([*Philippine Weather Bur. Ann. Rpt., 1919, pt. 1-2, pp 143*]).—This contains a brief account of the work of the weather bureau and a record of hourly meteorological observations made at the central observatory of Manila during the calendar year 1919.

SOILS—FERTILIZERS.

Soil survey of Coweta and Fayette Counties, Ga., D. D. LONG ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. III+34, fig. 1, map 1*).—This survey, made in cooperation with the Georgia State College of Agriculture, deals with the soils of an area of 411,520 acres, comprising two counties lying within the Piedmont Plateau region in western Georgia. The topography in the main is rolling, with some small areas of sharply rolling to hilly country, but becomes more broken as the rivers on the western and eastern borders are approached. The drainage is said to be complete.

The soils are of residual and alluvial origin. Including meadow, 12 soil types of 8 series are mapped, of which the Cecil sandy clay loam and sandy loam cover 51 and 13.7 per cent of the area, respectively.

Soil survey of Monroe County, Ga., D. D. LONG ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1920, pp. 36, fig. 1, map 1*).—This survey, made in cooperation with the Georgia State College of Agriculture, deals with the soils of an area of 252,160 acres lying in the Piedmont Plateau in central Georgia. In general the topography is rolling, ranging from undulating to strongly rolling or hilly. The drainage is said to be well established.

The soils of the county consist principally of residual or upland types with narrow strips of alluvial or bottomlands along the stream courses. Including meadow, 13 soil types of 7 series are mapped, of which the Cecil sandy clay loam and clay loam and the Davidson clay loam cover 46.2, 23.4, and 10.6 per cent of the area, respectively.

Polk County soils, W. H. STEVENSON, P. E. BROWN, ET AL. (*Iowa Sta. Soil Survey Rpt. 24 (1922), pp. 72, pl. 1, figs. 11*).—This survey deals with the soils of an area of 372,480 acres lying partly in the southern Iowa loess and partly

in the Wisconsin drift soil area in south-central Iowa. The area is said to be in general a rather level to gently rolling drift or loess-covered plain. The drift uplands throughout the area are flat to gently undulating, while the loess uplands are distinctly rolling. The drainage is said to be well established in the vicinity of certain of the larger streams, but in considerable areas of the more level upland occurring between certain streams in the central and western part of the county drainage is said to be poorly developed.

The soils of the county are classed as loess, drift, terrace, and swamp and bottomland soils, the drift soils covering over 60 per cent of the area. Including riverwash, muck, and peat, 33 soil types are mapped, of which the Carrington loam and Webster clay loam drift soils and the Tama silt loam loess soil cover 32.9, 17, and 11.1 per cent of the area, respectively.

The results of laboratory, field, and greenhouse tests to determine the fertility requirements and crop adaptations of the prevailing soil types are also briefly presented, indicating that many of the soils of the county are acid and that the organic matter content of many is insufficient. The phosphorus content is said to be somewhat variable, but in some instances rather low.

Winnebago County soils, W. H. STEVENSON, P. E. BROWN, ET AL. (*Iowa Sta. Soil Survey Rpt. 23* (1922), pp. 60, pl. 1, figs. 11).—This survey deals with the soils of an area of 255,360 acres lying within the Wisconsin drift soil area in north-central Iowa. The topography of the western part of the county as a whole is said to be almost level to gently rolling. The topography in the eastern part is said to be strongly rolling to moderately hilly. The drainage of the entire county is said to be inadequate.

The soils of the county are classed as drift, terrace, and swamp and bottomland soils, the drift soils covering over 80 per cent of the area. Including muck, peat, and meadow, 8 soil types are mapped, of which the Clarion loam and Webster clay loam drift soils cover 73.2 and 10.7 per cent of the area, respectively.

The results of laboratory, field, and greenhouse tests to determine the fertility requirements and crop adaptations of the prevailing soil types are briefly presented. These indicate that some of the soils of the county are acid, and that the upland types are not rich in organic matter. The phosphorus content is also said to be inadequate to supply any large number of crops.

Soil survey of the Delta area, Utah, A. T. STRAHORN ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. 38, pls. 4, fig. 1, map 1*).—This survey, made in cooperation with the Utah Experiment Station, deals with the soils of an area of 115,200 acres lying in the Sevier Desert in the northeastern part of Millard County in west-central Utah. Topographically, the area is a smooth plain, the surface of which is broken only by the low terrace forming the Lynn Bench and by the depressed channel of the Sevier River.

With minor exceptions, the soils of the area have been derived from somewhat weathered sediments deposited by the Sevier River. They are pre-vaillingly heavy in texture and range from light grayish brown or light brownish gray to dark gray in color. Both surface soils and subsoils are highly calcareous.

Including dunesand and rough stony land, 13 soil types of 7 series are mapped, of which the Oasis and Gordon clays, Oasis silty clay loam and fine sandy loam, and Abbott clay cover 24.7, 13.2, 12.9, 11.8, and 10.5 per cent of the area, respectively.

It is stated that the drainage is not always sufficient to remove the excess irrigation water, and as a result there are considerable areas in which un-

favorable alkali and moisture conditions have rendered the land worthless for cultivation. Irrigation is considered to be necessary for crop production.

Composition of the soils of Bell, Jefferson, Smith, Taylor, and Webb Counties, G. S. FRAPS (*Texas Sta. Bul. 301 (1922)*, pp. 5-66, figs. 7).—This bulletin deals with the chemical composition of samples of typical soils from five counties in Texas and supplements the respective physical surveys of the soils of these counties made in cooperation with the U. S. D. A. Bureau of Soils (E. S. R., 40, p. 120; 34, p. 213; 36, p. 621; 39, p. 212; and 26, p. 718).

Soil survey of Jackson County, Wis., W. J. GEIB ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918*, pp. 44, fig. 1, map 1).—This survey, made in cooperation with the Wisconsin Geological and Natural History Survey and the University of Wisconsin, deals with the soils of an area of 640,640 acres lying almost entirely within the unglaciated region in west-central Wisconsin. It is divided roughly into two distinct topographic and agricultural regions. The part west of the Black River is said to be to a considerable extent a rough, rolling country with soil of good quality predominating. East of the Black River the region is said to be largely an extensive sandy plain. It is stated that outside of the marshy tracts, except in the regions where shale occurs with the sandstone and along the flood plains of streams, the natural drainage is well established.

The soils are mainly of residual and loessial origin. Including peat and rough stony land, 19 soil types of 9 series are mapped, of which the Boone fine sand, Union silt loam, and peat cover 20.1, 18.9, and 15.7 per cent of the area, respectively.

Soil survey of Kenosha and Racine Counties, Wis., W. J. GEIB ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919* pp. IV+58, fig. 1, map 1).—This survey, made in cooperation with the Wisconsin Geological and Natural History Survey and the University of Wisconsin, deals with the soils of an area of 387,840 acres, comprising two counties lying within the Late Wisconsin glaciation in southeastern Wisconsin. The topography ranges from flat to level or gently undulating to broken. Practically all of the lowland is said to have very poor drainage or no drainage at all.

The soils of the area are said to be derived from glacial drift, water-laid materials, and cumuloose deposits. Including peat, muck, and dunesand, 31 soil types of 13 series are mapped, of which the Carrington and Miami silty clay loams cover 29 and 14.5 per cent of the area, respectively.

Opinions on chemical analyses of soils, K. A. VESTERBERG (*Internatl. Mitt. Bodenk., 12 (1922)*, No. 1-2, pp. 11-21).—This is a review of different opinions as to the value of chemical analyses in determining the availability of the nutrient content of soils and their fertilizer requirements. It is held that such analyses will be of value only when they can establish a minimum permissible concentration of each important plant nutrient in the soil solution for each individual plant.

Soil physics investigations [at the California Station] (California Sta. Rpt. 1922, p. 160).—Studies by E. V. Winterer on the effect of initial treatment of soil on moisture equivalent are said to have shown that the moisture equivalent will vary if samples of the same soil are held at different degrees of moisture for a brief period before making the determination. The structure of the soil is altered by this treatment, and it may afterward undergo air drying, oven drying, or pulverizing without restoring the original structure conditions in so far as they affect the moisture equivalent.

Preliminary studies by Winterer and R. E. Storie are said to have shown that the structure of adobe soils is somewhat altered by being cropped to rice.

The hygroscopic coefficient and the volume of contraction of the rice soils were lower than adjacent similar soils that were never cropped to rice. Neither the volume weight nor the organic matter content showed any consistent differences, but the pore space of the rice soils was somewhat larger.

Evaporation from soil, A. POHLMANN (*Internatl. Mitt. Bodenk.*, 12 (1922), No. 1-2, pp. 36-53).—Studies on evaporation from sand, loam, and moor soils under conditions involving different shapes of soil surface, highest water content of the soils, different thicknesses of soil layer, and different water contents of the soil are reported.

It was found in general that evaporation from all the soils increased as the soil surface increased, and proceeded according to a logarithmic curve. Level soil surfaces evaporated more water per unit area than surfaces cut into rows.

Both the absolute and relative amounts of evaporation were greatest from the dunesand soil, followed in order by the tertiary quartz sand, loam, and moor soils. Evaporation was less the finer the soil particles.

It is concluded that evaporation from soils depends not only on grain size but much more on the moisture capacity of a soil. This in turn increases with the fineness of material, and is influenced by the arrangement and condition of grains. It was found that the greater the absorptive power of a soil for water the greater was the evaporation during a given period. Only the hygroscopic water remained in thin layers of soil after evaporation ceased. As the soil increased in depth some capillary water also remained.

Evaporation from moor soils and moor soils covered with sand, E. KRÜGER (*Internatl. Mitt. Bodenk.*, 12 (1922), No. 1-2, pp. 4-10).—This is an extension of previous studies on the subject (*E. S. R.*, 44, p. 210) to include fine and coarse sands of different grain size.

It was found that in dry weather the evaporation from plain moor soil was greater than from soil covered with fine sand. The evaporation from moor soil covered with coarse sand was less than that from the other soils. These conditions were reversed during the first days following a rain. As soon as the surface of the coarse sand became dry the original conditions as regards evaporation prevailed again. However, evaporation continued from the soil covered with fine sand for some time. These conditions prevailed especially where the rainfall was heavy enough to wet the sand covering through completely.

Investigations on the influence of the mechanical properties of soil on the growth of roots, M. TROMMER (*Landw. Jahrb. Bayern*, 10 (1920), No. 5-6, pp. 163-219, figs. 6).—Pot and field experiments on the penetration of roots through surface soil, the action of roots against different forms of resistance, and the distribution of roots and the shaping of root systems in different soil materials in strata of varying densities are reported.

It was found that the common crops are able to penetrate deeply into very dense soils under favorable moisture conditions. Sand in dense stratification was penetrated with the greatest difficulty and loamy sand the most easily. The loam offered a medium resistance. Coarse-grained sand was more difficult to penetrate than fine-grained sand. The penetration of dense sand was facilitated by the addition of clay.

The roots developed a shorter and more compact structure in dense soils than in loose soils. The number, length, and ramifications of roots in top soil were increased by the presence of a dense subsoil. The holes made by roots and earthworms in soil were without importance for the mechanical distribution of roots. There was no fundamental difference between the depths

and powers of penetration of tap and bunch roots, although the slender roots had greater penetrating powers than the thick, heavy roots.

The air content of soils was found to be of some considerable importance in root distribution owing to the oxygen requirements of the roots.

The influence of different degrees of density of soils on the above-ground parts of plants is not due so much to the mechanical influence on the roots as to the influence on the distribution and utilization of moisture and nutrients and on ventilation.

Organic constituents of the soil, G. S. FRAPS (*Texas Sta. Bul. 300 (1922), pp. 5-14*).—Chemical studies of the organic carbon of different soils are reported, in which the determination of organic carbon in the soil seemed to throw little light on the quality of the soil and is hardly necessary for ordinary soil analysis.

It was found that the percentage of organic carbon can be judged from the percentage of nitrogen present, and that the average percentage of pentosans increases with the average nitrogen content of the soil. Surface soils contained slightly more pentosans in proportion to nitrogen than subsolls, but the difference was very small.

Pentosans in cottonseed meal disappeared rapidly from the soil during the first week, and at the end of eight weeks 7 per cent of the original pentosans from cottonseed meal was present, 31 per cent from Sudan grass, 61 per cent from rice bran, and 75 per cent from sheep excrement. The amount of reducing substance calculated as sugars, produced by heating the soil with 1.25 per cent sulphuric acid, varied from 0.002 to 0.215 per cent, with an average of 0.058 per cent for 77 soils.

The nitrogen insoluble in permanganate was studied, but no relation could be found between the soluble and insoluble nitrogen and the results of pot experiments with nitrogen on soils. A 10 per cent salt water was found to dissolve an average of 0.005 per cent of nitrogen from 43 soils containing an average of 0.146 per cent of total nitrogen. These results are considered to be of little significance. An average of 10 per cent of the nitrogen from 21 soils was dissolved by N/10 potassium hydroxid.

Some factors affecting the hydrogen-ion concentration of the soil and its relation to plant distribution, W. R. G. ATKINS (*Roy. Dublin Soc. Sci. Proc., n. ser., 16 (1922), No. 30-34, pp. 369-413*).—The results of studies conducted at Trinity College, Dublin, at the Marine Biological Laboratory, Plymouth, at the Agricultural Research Institute, Pusa, and at various other institutions are reported, in which it was found that with the soils studied the theoretical maximum alkalinity due to calcium carbonate only is pH 9.01, which may be attained experimentally in the absence of carbon dioxide. The corresponding bicarbonate in equilibrium with the gases of the atmosphere is at pH 8.37 at 16° C., becoming more alkaline at higher temperatures. Owing to the high content of carbon dioxide in the soil, the pH values of limestone soils are usually lower and vary with the aeration.

The theoretical maximum alkalinity for magnesium carbonate was found to be pH 10. This is taken to indicate that dolomite soils may thus attain to greater alkalinity than limestone soils. Alkalinity of over pH 10 due to sodium carbonate could be reduced to pH 8 by the addition of calcium sulphate. The former reaction is considered to be injurious or destructive to vegetable cells, while the latter is favorable to most plants.

It was further found that soil acidity may be occasioned by the oxidation of sulphur from iron pyrites. Such acidity favors the production of available phosphate and is accordingly beneficial to certain plants. Owing to the pro-

duction of carbon dioxid by bacteria, a soil extract may decrease in alkalinity from pH 8.7 to pH 7.2 or less. The result in the soil appeared to be to render iron salts more readily available in calcareous soil when inundated than when uncovered. The alteration was usually more rapid in soils from the top 6 in. than at greater depths.

Continuous manuring with ammonium sulphate or potassium sulphate decreased the effective soil alkalinity even in a calcareous silt, but by a small amount only. An acid soil extract was only slightly altered by boiling, while alkaline extracts tended to reach the maximum value for calcium carbonate. Higher values such as pH 9.2 appeared to indicate the presence of small amounts of magnesium. The altered reaction is considered to be of probable importance in inhibiting the growth of certain soil organisms in heated soil.

Soils derived from calcareous silt were found to be the most alkaline, followed in order by those derived from limestones, sandstone, calcareous tuff with slate, slate, pillow lava, felsite, and granite. These conditions were modified in certain places, since proximity to the coast lessens acidity and a high gradient often increases it.

Records are given for the H-ion concentration of the habitats of over a hundred native plants. These showed that this measurement is a valuable index of various soil conditions, and that many plants are limited to a short range of pH values. Others with a wider range occur mainly in one portion of it, but some plants grow well at widely different soil reactions. It is emphasized that a distinction must be made between acid peaty soils, acid clay soils, and acid sandy soils.

Natural waters even from the peaty districts examined contained no acid other than carbonic acid. It was found that water in a spring may have a pH value of 6.4 and the stream flowing from it a pH value of 8.3 when in equilibrium with the atmospheric concentration of carbon dioxid. Photosynthesis may raise water containing magnesium salts to pH 9.7. The method of limiting ionic concentrations may be applied to determine the amount of calcium carbonate in a soft water. It was found that the H-ion concentration of natural soft waters tends to increase during the winter and to decrease during the summer.

Alkali investigations [at the California Station] (*California Sta. Rpt* 1922, pp. 50, 51, 52, 53).—In experiments with vineyard soils, by W. P. Kelley (E. S. R., 47, p. 619), it was found that simple leaching without gypsum proved in certain cases to be almost as effective as when gypsum was used, while in other cases leaching alone was less effective.

Field experiments on the effect of the use of elemental sulphur showed that sulphur produced very little chemical effect on alkali. Laboratory studies by E. E. Thomas showed that sulphuric acid, gypsum, elemental sulphur, ferrous sulphate, and alum are effective means of neutralizing black alkali.

Studies by A. B. Cummins on the formation of sodium carbonate in soils (E. S. R., 47, p. 619) showed that almost any soil can be made alkaline by first treating it with a neutral sodium salt and then leaching. It was also found that several different pure minerals when treated with a neutral sodium salt and then leached give alkaline solutions.

Studies by A. R. Davis and West on the effect of common salt on wheat, barley, rye, and dwarf peas grown in the greenhouse in solution cultures (E. S. R., 47, p. 620) showed that the tolerance limits for sodium chlorid were about the same for all the plants. In general, plants in concentrations of 9,000 parts per million reached maturity before death occurred. Above this limit growth was inversely proportional to salt concentration until the limit of 15,000 parts per million was reached. Above that point no growth took place.

The peas were slightly more susceptible to the higher concentrations than the cereals. In all plants certain concentrations of salt differing with the plant used stimulated vegetative growth. A direct relation was evident between the salt added and the time of maturity, the general effect of the sodium chlorid being to hasten this process.

Studies of the areas of soils affected by alkali in the State, compiled by C. F. Shaw, showed that of the 13,191,682 acres surveyed in the Sacramento and San Joaquin Valleys about 14.6 per cent are affected by alkali accumulations.

Studies by W. W. Mackie on the influence of rice production on the alkali content of soil showed that the loss of alkali from the soil under rice irrigation averaged 28 per cent. A selective action retained the sodium sulphate and chlorid ions but permitted the bicarbonate, calcium, and magnesium ions to pass. A small increase in alkalinity was apparent in the soil with the appearance of carbonate and bicarbonate ions. A more disturbing feature was the loss of calcium and magnesium and the increase of the sodium. Deposits of silt from rice irrigation varied from 3 in. near the intake of the plats to 0.5 in. or less at the most distant points.

Relation between the chlorin index and the nitrogen content of soil, C. VEIL (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 5, pp. 317-319).—Experiments to determine the relation between the so-called chlorin index of soils and their nitrogen content are reported. The chlorin index is determined by the loss of chlorin when soils are treated with sodium hypochlorite.

The index was found to depend upon the humus content of the soil, and in general to increase as the nitrogen content increased. Where the nitrogen content exceeded 0.4 per cent in very fertile soils the chlorin index exceeded 30. Where the humus content was low and the nitrogen content less than 0.1 per cent, the chlorin index varied between 7 and 12. A series of soils of average fertility having nitrogen contents greater than 0.1 and less than 0.2 per cent showed chlorin indexes varying from 15 to 27.

Variations in the capacity of *Clostridium pastorianum* for nitrogen fixation, G. TRUFFAUT and N. BEZSSONNOF (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 19, pp. 868-870).—Further studies on the subject are reported (E. S. R., 47, p. 319), showing that the partial sterilization of soil by calcium sulphid increases the numbers of *C. pastorianum* and their capacity for nitrogen fixation. This stimulating influence of partial sterilization is no longer evident after repeated cultures in synthetic media.

It is concluded that a factor injurious to the development of *Clostridium* in artificial cultures exists in the soil. The influence of this factor is apparently rendered insensible when cultures are produced with soil dilutions approaching 1 to 100,000. A soil dilution of 1 to 100,000 gave a much greater relative activity of *Clostridium* in nitrogen fixation than a dilution of 1 to 10,000.

Sulphur transformation in soil, K. LANTZSCH (*Internatl. Mitt. Bodenk.*, 12 (1922), No. 1-2, pp. 22-35).—Studies are reported which showed that no reduction of sulphates to sulphids took place in alkaline humus soils. It is concluded that the evolution of hydrogen sulphid from these soils resulted from the decomposition of albuminous compounds, and that there is no basis for the assumption that sulphur appears in soils as free sulphuric acid or as sulphids and as such is leached out or acts as a solvent. A marked increase in soil acidity was brought about only after large additions of sulphur. Active soils apparently contain only small amounts of sulphur subject to transformation, and such transformation as occurs is attributed to albumin decomposition.

On the other hand, it was found that nitrogen is able to enter into transformation processes resulting in free acids which act on both lime and phos-

phoric acid. The seasonal maxima of nitrification were found to occur at the same time that the maximum amounts of phosphoric acid were found in soil solutions extracted by pressure.

The needs of the soils of Brazos and Jefferson Counties for sulphur, S. LOMANITZ (*Texas Sta. Bul. 302 (1922), pp. 5-23, figs. 2*).—Chemical analyses of samples from a number of soils from Brazos and Jefferson Counties, Texas, and pot experiments with soils from Brazos County, to determine their requirements for sulphur, are reported and discussed. The pot experiments were conducted with corn, sorghum, alfalfa, and some cotton for two years to test the effect of applications of sulphur.

Both series of experiments indicated that these soils are not deficient in sulphur. Sulphur exercised a harmful effect upon some of the soils of Brazos County, reducing the yield and causing the plants in some pots to die very young. The acidity of some Brazos County soils was increased by the addition of sulphur. No relation was found between the percentage of nitrogen and that of sulphur in the sorghum grown in the pots. The plants showed a tendency to assimilate more sulphur with an increased supply of this substance. The soils tested from Brazos County were found to contain more sulphur than phosphoric acid.

A list of 57 references to literature bearing on the subject is appended.

[Soil and fertilizer investigations at the California Station] (*California Sta. Rpt. 1922, pp. 114, 116*).—Studies by A. R. Davis on the effect of carbohydrate material upon nitrogen fixation under natural conditions are said to indicate that bean straw, barley straw, and alfalfa when added to the soil slightly stimulated nitrogen fixation. Sawdust of various kinds had no such effect.

Studies on modification of soils through climatic influences, continued by Davis, indicated that soils from the same source have been modified greatly, especially as regards general appearance and biological activity, by the climatic influences peculiar to the different stations.

Experiments by W. F. Gericke to determine the reason for the superiority of ammonium sulphate over sodium nitrate in fertilizer tests with wheat and barley on sand and adobe soils are said to have indicated that this superiority may be explained by the fact that ammonium sulphate requires some time to become nitrified, thereby supplying available nitrogen to the plant at stages of growth when it can be utilized most efficiently.

Fertilizers before and after the war, J. HENDRICK (*Highland and Agr. Soc. Scot. Trans., 5. ser., 34 (1922), pp. 93-114*).—A review is given of the fertilizer situation before, during, and after the war, more especially with reference to conditions in Great Britain. It is stated that the general effect of the war has been to increase the potential supplies of all the three great classes of fertilizers, but temporarily to decrease the demand. Special attention is drawn to the number of new and unfamiliar nitrogenous fertilizers on the market.

Field experiments with oats and hay conducted at the Craibstone experimental farm are briefly reported, showing that the newer nitrogenous fertilizers such as ammonium nitrate, ammonium chloride, and urea gave crop increases similar to those given by sodium nitrate and ammonium sulphate. Calcium cyanamid was the only new nitrogenous fertilizer which did not do as well as the old well-known sources of nitrogen.

The phosphate situation is said to indicate the importance of a more extensive use of the relatively insoluble natural phosphates. The advantage of the solubility in water of superphosphate is considered to be much overrated and the value of the insoluble phosphates much underrated. In this connection

the results of 66 experiments with turnips conducted for four years on a great variety of soils in the counties of northern and northeastern Scotland are briefly summarized.

These showed that any phosphatic fertilizer used, whether of the soluble or insoluble type, gave marked increases in crop yields when applied along with a moderate application of barnyard manure and some nitrogenous and potassic fertilizer. Superphosphate gave the best results, but the results given by basic slag and North African mineral phosphate were only slightly inferior. When superphosphate was mixed with twice the amount of phosphoric acid in the form of an insoluble phosphate, the crop obtained was as great as if the whole of the phosphoric acid had been applied as superphosphate. These results are taken to indicate that for the soils of Scotland ground mineral phosphates on the average show results not much behind those given by an equal amount of phosphate in the form of superphosphate, and that, generally speaking, ground mineral phosphates such as North African phosphates give results, weight for weight of phosphate, almost equal to those given by high-grade basic slag.

It is stated that at present the different potash manures available in Great Britain are all more or less interchangeable and do not differ greatly in value. The results of field experiments with potatoes conducted at Craibstone during 1921 are summarized, showing that the potassic manures used gave about the same crop increases, with the advantage slightly in favor of the French sylvinite and the German kainit.

The feeding power of certain cereals and their response to fertilizer ingredients, R. L. HARTWELL and F. R. PEMBER (*Rhode Island Sta. Bul.* 190 (1922), pp. 4-27, figs. 2) —Field and pot experiments extending over a period of 10 years to determine the difference in the feeding power and fertilizer response of certain cereals in connection with the development of economical practice in the use of fertilizers are described in this bulletin. The soil used was Miami silt loam.

In the field a low response to nitrogen was exhibited by rye, to phosphorus by buckwheat, oats, and millet, and to potassium by rye, oats, millet, and wheat; a medium response to nitrogen by oats and wheat, to phosphorus by barley, rye, and wheat, and to potassium by barley and buckwheat; and a high response to nitrogen by millet, buckwheat, and barley. Usually the conditions favored oats, buckwheat, and millet more than the other crops.

In order that each field crop might be subjected to the same soil conditions, the crops were occasionally planted crosswise of the plats in one year and lengthwise in the succeeding year. This afforded opportunity, incidentally, to ascertain the effect of the cereals of one year on the same when grown the next year. Each cereal grew somewhat better following wheat, barley, and oats than following rye, and also following buckwheat instead of millet. The influence of the preceding crops was manifested most markedly in the case of buckwheat, the growth of which was very much depressed where millet was the preceding crop.

In 1920, nitrogen was determined in all the cereals on at least three different dates, and when grown with fertilizers having eight different analyses. The percentage of nitrogen in dry matter decreased with the smaller proportion of leafy tissue as the crops approached their full growth. By comparing the nitrogen percentages where none and where the maximum amount of a given nutrient were applied, the usual marked increase occurred with maximum nitrogen, a decrease of nitrogen with maximum phosphorus, and, with few exceptions, a decrease with maximum potassium, which element was the one least deficient in the given soil. On later dates the percentage of

nitrogen which the crops had retained where there was liberal fertilization decreased in the order of barley, wheat, oats, buckwheat, rye, and millet.

Where less than a nutrient requirement of a crop was supposed to be present, the dry matter produced with that limited amount was frequently less than it should have been had other factors been ideal.

Analyses of the crops of the first two years of the pot experiment showed that as usual the lowest percentage of an element occurred when the carrier of that element was withheld from the fertilizer, and the addition of the carrier usually led to an increased percentage. The addition of each fertilizer nutrient caused a sufficient increase in yield so that the percentages of the other two were decreased. The percentage of potassium was decreased more than that of nitrogen by the addition of phosphorus, nitrogen was decreased more by phosphorus than by potassium, and phosphorus more by nitrogen than by potassium.

The carriers of the nutrients exerted their effect in the following decreasing order: Phosphorus, nitrogen, and potassium, not only in respect to their effect on reducing the percentages of each other but also on crop increase.

The problem of the salt pan, H. O'K. WEBBER (*So. African Jour. Indus.*, 5 (1922), No. 6, pp. 265-269).—An account is given of the conditions prevailing at the Matzap salt pan in the Cape Province of South Africa. The results of boring operations are presented and discussed, indicating the existence of underground brine-carrying beds in the area which appear to be extensive.

The upper bed of sandy clay, approximately 16 ft. thick, was found to be saturated by a nitrate-bearing brine containing an aggregate heavy tonnage of valuable salts. The specific gravity of this brine did not appear to vary when the surface of the pan was flooded, provided the surface water was excluded from the sump. The water of a small perennial spring trickling into the pan contained a small quantity of nitrates. Analyses of the soil near the surface of the pan showed the presence of from 1 to 2 per cent of nitrates. The brine found at considerable depth over the whole area below the layer of dry shaley clay was found to be much more highly concentrated than the upper brine. It contained between 4 and 5.75 tons of nitrate per 20,000 gal. of brine.

Report on the fixation and utilization of nitrogen (Washington: War Dept. [U. S.], Nitrate Div. Ordnance Off., 1922, pp. XII+353).—This report, prepared by the Nitrate Division of the Ordnance Office, U. S. War Department, assisted by the Fixed Nitrogen Research Laboratory of the U. S. Department of Agriculture, discusses the world's nitrogen supply and demand, the prices of nitrogen, and the development of nitrogen fixation in this and in foreign countries. A technical and engineering description of the several nitrogen fixation and conversion processes and discussions of research in its bearing both on the present and future possibilities of fixation are also presented. A history of the Government's activities in nitrogen fixation is outlined, including a description of its nitrogen fixation plants. A bibliography is appended.

The oxidation of ammonia—the work of the Sheffield Experiment Station, H. A. CURTIS (*Chem. and Metall. Engin.*, 27 (1922), No. 14, pp. 699-703, figs. 3).—This is a study of the fundamental conditions involved in the catalytic oxidation of ammonia and a résumé of the important unsolved problems. These are enumerated as the more economical use of platinum catalysts, nonplatinum catalysts, use of multiple gauzes, the relation of the ammonia content of the gas, gauze temperature, rate of gas flow through gauze, and efficiency of ammonia oxidation, increasing the oxygen content of the gas mixture ahead of the gauze, apparatus for the continuous analysis of gas mixtures, and catalysis of the oxidation of nitric oxid to nitrogen peroxid.

Studies on the action of normal and excess applications of different nitrogenous fertilizers as top-dressings on winter grains, L. HILTNER and F. LANG (*Landw. Jahrb. Bayern*, 10 (1920), No. 1-2, pp. 23-38).—Experiments are reported which showed that considerably heavier top-dressings of nitrogenous fertilizers than are customary may be profitably applied to winter grains on the gravelly soils and other light soil types of the Swabian and Upper Bavarian uplands.

Applications of double the customary amount of top-dressing of favorably acting nitrogenous fertilizers doubled the yields of grain and straw of winter rye and wheat and produced a marked increase in net profit. The increased yields and net profit with barley were not so important. Ammonium sulphate gave the best results in such practices, and proved throughout the experiments to be a highly effective nitrogenous fertilizer for winter grains. Lime nitrogen gave only moderate results, but caused profitable increases in almost all cases. Ammonium chlorid gave striking results only when it was added in large amounts and in two applications. Sodium nitrate gave the best results when used in large and extra large quantities in two and three applications, respectively. It was necessary for the crops to be dry to prevent injury during the application of heavy top-dressings of these fertilizers, especially lime nitrogen.

Tests of the action of increasing nitrogen applications, CLAUSEN (*Deut. Landw. Presse*, 49 (1922), Nos. 30, pp. 207, 208; 31-32, pp. 216, 217; 33, p. 227).—In connection with studies on the value of different sources of nitrogen, experiments on the fertilizing action of increasing applications of potassium ammonium nitrate and ammonium sulphate nitrate to rye, oats, potatoes, grass, and beets on loamy sand, sandy loam, loam, and especially on sand soils deficient in lime, are reported.

The results of the first year of these experiments showed that with proper basic fertilization on normal soils these nitrogenous fertilizers were profitably used in a majority of cases, and that the use of considerably larger applications than is customary was profitable.

Fertilization with increasing additions of ammonium sulphate to potatoes on moor soil, W. FELDT, R. HOFFMANN, W. WÖLK, and E. WEDELL (*Mitt. Ver. Förd. Moorkult. Deut. Reiche*, 40 (1922), No. 10, pp. 224-227).—Studies to determine the influence of increasing amounts of nitrogen in the form of ammonium sulphate on the productivity of moor soil, as indicated by the growth and yield of potatoes, are reported. The moor soil had been treated for years with potash and phosphoric acid fertilizers. Ammonium sulphate increased the potato crop when added up to a certain amount, beyond which the increases were smaller until a point was reached at which a marked depression in yield below that from the check plots occurred. This depression increased as the amount of ammonium sulphate used increased. This result is attributed to the physiologically acid reaction of the ammonium sulphate.

"Ammonium bicarbonate," a new nitrogenous fertilizer, A. STUTZER (*Deut. Landw. Presse*, 49 (1922), No. 65, pp. 423, 424).—Experiments at three different German experiment stations on the fertilizing action of ammonium bicarbonate on potatoes as compared with ammonium sulphate are briefly reported. The ammonium bicarbonate gave as good results as the ammonium sulphate in all three cases, and on strongly acid soil it gave much better results.

Investigations on the availability of the phosphoric acid of Thomas phosphate and some other phosphates by means of sand cultures, J. G. MASCHHAUPT (*Dept. Landb. Nijv. en Handel [Netherlands], Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefsta.*, No. 27 (1922), pp. 82-113).—In a continua-

tion of investigations on the solubility and rate of solubility of different phosphates in water saturated with carbon dioxide (E. S. R., 42, p. 125), a series of cylinder studies are reported on the ability of different phosphates to supply satisfactorily the phosphoric acid requirements of plants under controlled growth conditions in sand cultures. Oats was used as the crop. The phosphates tested included tricalcium phosphate, bone meal, Florida phosphate, Algerian phosphate, and Thomas meal phosphates of high, medium, and low citrate solubility.

The results indicated that the value of a phosphate for the nutrition of plants depends primarily upon the solubility of its phosphoric acid, and that plants impose fixed requirements upon the concentration of the phosphoric acid in the soil solution. A high rate of solubility such as was shown by tricalcium phosphate and bone meal did not compensate for a lower total solubility.

The method of determining the relative solubilities of phosphates in 2 per cent citric acid, according to Wagner, was found to separate the low-grade from the high-grade Thomas phosphates. However, it failed to indicate satisfactorily the relative fertilizer values of the other phosphates, and it indicated too high a fertilizer value for some of the low-grade Thomas phosphates. The use of water saturated with carbon dioxide was found to be more satisfactory, but likewise indicated too high a fertilizer value for certain low-grade phosphates.

The results of the sand cultures with oats indicated that the Thomas phosphates were the most effective from the higher to the lower grades, followed in order by the tricalcium phosphate, bone meal, Florida phosphate and Algerian phosphate.

It is emphasized that the results of this study may be applicable only to oats and to conditions of basic fertilization employing sodium nitrate as the source of nitrogen, and that the use of other crops or of physiologically acid sources of nitrogen may give different results.

The relationship between citric solubility of phosphates and yield of turnip crop, J. F. TOCHER (*Highland and Agr. Soc. Scot. Trans.*, 5. ser., 34 (1922), pp. 196-207).—Field studies with turnips to determine the relative values of different sources of phosphoric acid are briefly reported. It was found that equivalent quantities of phosphate will give practically identical mean weights of turnips under similar conditions, irrespective of whether slag, mineral phosphate, reverted phosphate, or superphosphate is used.

Field experiments with rock phosphates and basic slags.—II, Effect on the quality of hay and pasture, G. S. ROBERTSON (*Jour. Min. Agr. [London]*, 29 (1922), No. 7, pp. 600-605, pls. 2, figs. 2).—In continuation of work previously reported (E. S. R., 48, p. 122), studies of the effect of rock phosphates and basic slags on the quality of hay and pasture are reported.

It was found that rock phosphates produced exactly the same type of improvement in the quality of the hay crop and the pasture as the most soluble types of open-hearth basic slag, and they were quite as effective in this respect. The open-hearth fluorspar slags of low solubility were not so consistent in their behavior, and the evidence indicates that the less soluble types do not improve the hay crop to the same extent as the more highly soluble slags. The action of phosphates on grassland was not confined to developing the clovers, as they had a very decided effect in improving the quality of grasses. The evidence indicates that the improvement in the grasses is more likely to be due to the benefit of the direct fertilizing effect of the phosphates, or to the action of the phosphates on the production of nitrates in the soil, than to the collection of nitrogen by the clover plant.

The agricultural value of sea sand, W. BORLASE and A. GREGG (*Jour. Min. Agr. [London]*, 29 (1922), No. 7, pp. 591-599).—A summary of information is given on the practice of applying sea sand to the land in Cornwall. It has been found that the chemical effects on soil are apparently confined entirely to the action of the calcium carbonate which the sand contains in the form of powdered shell. Studies showed that neither phosphates nor salts of potash or magnesia are present. The calcium carbonate content bore no relation to the mechanical composition of this sand.

Cropping experiments in which the sea sand was compared with burnt lime and ground limestone showed that in all cases the best results were obtained with sea sand. Other cases indicating the value of sea sand on these soils are cited.

Inspection of commercial fertilizers, H. D. HASKINS, L. S. WALKER, and R. W. SWIFT (*Massachusetts Sta. Control Ser. Bul. 20* (1922), pp. 42).—This bulletin contains considerable information regarding the fertilizer industry in Massachusetts for the year 1922, and summarizes the results of chemical analyses of 1,448 samples, representing 547 distinct brands.

It is stated that the fertilizer trade in Massachusetts for the 1922 season showed an 8 per cent increase in tonnage over that of the 1921 season. The consumption of low-analysis mixed fertilizers was but 17 per cent of the total consumed in the State, as compared with 28 per cent for the 1921 season. Of the mixed fertilizer tonnage, 71 per cent was confined to 10 grades. This is taken to indicate the effectiveness of the movement to eliminate unnecessary, uneconomical, and unreasonable grades of mixed fertilizer.

Of the total tonnage sold during the season, 72 per cent consisted of mixed goods and 28 per cent of chemicals and unmixed fertilizer by-products. Of the mixed goods sold, 98.5 per cent were complete fertilizers and the remainder consisted of ammoniated superphosphates and superphosphates with potash. About 53 per cent of the ammoniated superphosphates and superphosphates with potash were low-analysis goods.

Inspection of lime products used in agriculture, H. D. HASKINS, L. S. WALKER, and R. W. SWIFT (*Massachusetts Sta. Control Ser. Bul. 21* (1922), pp. 7, fig. 1).—This bulletin contains guarantees and actual analyses of 27 different brands of agricultural lime and 3 brands of gypsum collected for inspection in Massachusetts during 1922. Information is also included on the physical nature of some of these products.

Analyses of fertilizers, spring season, 1922 (*N. C. Dept. Agr. Bul., Aug., 1922, Sup., pp. 11*).—The results of actual analyses, guarantees, and relative valuations of 234 samples of fertilizers and fertilizer materials collected for inspection in North Carolina during the spring season of 1922 are presented.

Proceedings of the twenty-ninth annual convention of the National Fertilizer Association (*Natl. Fert. Assoc. Proc., 29* (1922), pp. 152).—The proceedings of the convention are given in detail.

AGRICULTURAL BOTANY.

[Plant nutrition studies at the California Station] (*California Sta. Rpt. 1922, pp. 114, 115, 116, 117*).—From a continued study on the effect of the light-temperature-humidity-complex on the growth of plants in culture solutions, A. R. Davis claims that the relationship between any two culture-solution types may be profoundly modified by the climatic complex. This influence is said to be so great at times as to prevent the duplication of experiments by the same investigator working in the same laboratory.

From preliminary experiments with barley grown in culture solutions, D. R. Hoagland and J. C. Martin have determined the concentration of phosphate ion essential to the development of the plant. It was found that good growth could be obtained with concentrations of phosphate far lower than those usually employed in solution cultures.

Hoagland, studying the absorption of nutrients by plants, found marked differences to exist in the barley plant as to rate of absorption of different ions that are not necessarily related to their essential nature. The influence of cation on anion and vice versa is said to be of importance. Equilibrium points may be reached so that the intake of certain ions may not be continuous, even when these are available in the solution. Potassium and nitrate, however, were absorbed at all periods and may be stored in large excess.

A study of the utilization of nutrients by legumes, carried on by a graduate student, showed that in the case of peas and vetch no selective action different from that of barley was discovered. When grown in soil, the legumes were found to accumulate larger proportions of calcium, probably because of their ability to excrete from their roots larger amounts of carbon dioxide, thus causing more calcium to enter into solution. No definite relation between nitrogen and calcium metabolism could be determined in these plants.

W. F. Gericke, studying the physiological processes related to root systems of plants, found that the paucity of nitrogen in the growth media contributed greatly to the production of relatively large root systems by wheat and barley. The lack of potassium may likewise promote growth of long roots by the barley and wheat plant. However, the ratio by weight of roots to tops is much less when potassium, instead of nitrogen, is deficient. Large root systems were found to act as a protective agency against injury from salts, and it was demonstrated both by soil and solution-culture experiments that plants which had the largest root systems tillered more profusely on the application of nitrogen than did those having less root growth.

In studies of complete nutrient solutions and the growth of wheat in combinations of one-salt nutrient solutions, Gericke found that the relation of potassium to nitrogen is of considerable physiological importance. A mixture of potassium nitrate, calcium sulphate, and magnesium phosphate was the only combination of three one-salt solutions in which wheat plants would grow equal to those in complete well-balanced nutrient solutions. The proper pairing of certain elements was found to play an important part in the adaptability of a nutrient medium for plant growth. The absorption and utilization by plants of the nitrate anion is said to be largely dependent and conditioned on the absorption of the potassium cation at the same time. Two nutrient solutions at a time, if suitably combined, were found to permit of normal growth of wheat. Magnesium phosphate was found nontoxic, and it could supply the wheat plant with the necessary magnesium and phosphorus for its growth. Magnesium nitrate or magnesium sulphate produced injury. It was found that calcium, magnesium, phosphate, and sulphate could be omitted from the solution for four days continuously, and for two-thirds of the growing period, without apparent injury or inhibition to growth.

[Plant nutrition studies at the Citrus Experiment Station] (*California Sta. Rpt. 1922, pp. 71, 72*).—Analyses were made by H. S. Reed and A. R. C. Haas of leaves, shoots, trunk, root, and rootlets of young citrus trees grown in cultures supplied with the various elements required for growth. It is claimed that all parts of the trees were relatively rich in calcium, potassium, and carbonates. The trunk and roots contained more sodium than other

parts, while the ash of the rootlets of trees grown in sand cultures was noticeably rich in potassium, calcium, and phosphorus. Total nitrogen as well as total ash was highest in the leaves and rootlets. In general, an increase in the amount of an ingredient in the nutrient was reflected by a corresponding increase in the amount of that element in the ash of the tree.

Reed and Haas also report the pseudo-antagonism of sodium and calcium in salts of dilute solutions. Citrus seedlings were grown in the absence of calcium, and it was found that the root systems showed injury in the superficial layers and the ultimate death of the root, while the tops did not show the effect for some time after injury to the roots had become severe. The addition of calcium to cultures induce the production of lateral rootlets, and, except in cases of advanced injury, recovery occurred. It is claimed that in very dilute solutions amounts may be present so far below the equilibrium point as to result in a condition of starvation, and in such cases it is starvation and not antagonism that produces the results. The experiments are held to show that there is no antagonism between sodium and calcium when the plants are grown in very dilute solutions.

Reed has presented a graphic method for obtaining constants for formulas of organic growth.

Effects of salts and alkalinity on plant growth (*California Sta. Rpt. 1922, p. 51*).—Continuing previous work (E. S. R., 47, p. 625), D. R. Hoagland found that marked changes in the composition of barley plants may be brought about by concentrations of sodium chlorid and sodium sulphate that are only slightly inhibitive of growth. It was found that the percentage of calcium, magnesium, and potassium may be reduced to a marked extent when sodium salts are added to the nutrient solution. Sodium chlorid is said to be absorbed much more readily than sodium sulphate. In comparing the toxicity of various salts, it appears that for equal osmotic concentrations, sodium sulphate has a toxicity equal to that of sodium chlorid in the case of barley, while the former is more toxic to cantaloups, cucumbers, and perhaps other plants. Calcium chlorid is one of the most toxic salts for barley. Cantaloups, watermelons, and cucumbers have been found to be extremely sensitive to alkalinity, both in cultures and in the soil.

A. R. Davis and West investigated the effect of common salt on wheat, barley, rye, and dwarf peas. The tolerance limits were about the same for all plants employed. In general, plants in concentrations of 9,000 parts per million reached maturity before death occurred. Above this limit, growth was inversely proportional to the salt concentration. In all plants certain concentrations of the salt, differing with the plant used, stimulated vegetative growth.

Dormancy and hardiness in the plum, P. D. STRAUSBAUGH (*Bot. Gaz.*, 71 (1921), No. 5, pp. 337-357, figs. 4).—In the plum there are widely differing degrees of dormancy among the different species and varieties. There appears to be a definite relation between dormancy and hardiness. During the period of dormancy the moisture content of the semihardy varieties fluctuates with the temperature. When the fluctuations in the moisture content of buds were found to occur under orchard conditions, this phase of the problem was checked under control in the laboratory by placing the twig-bud system in sealed chambers over different concentrations of sulphuric acid. By this method water movement in the tissues was studied in three varieties. Lenticel number per unit area was found to be correlated with the difference in moisture-retaining capacity.

This investigation has a direct bearing upon the problem of selecting seedling fruits for hardiness.

Afterripening and germination of *Juniperus* seeds, D. A. PACK (*Bot. Gaz.*, 71 (1921), No. 1, pp. 32-60, fig. 1).—Studies are detailed as carried out with seeds of *Juniperus* spp. showing only about 1 per cent germination under ordinary conditions (above 15° C.) without opportunity for afterripening. These seeds are protected by a semipermeable and thick coat which makes up 75 per cent of the weight of the entire seed. Acids enter very slowly, while bases and silver and mercury salts enter rapidly. Though the coat serves as a protection against attack by fungi and prevents water-imbibed seeds from expanding and rupturing the tissues before afterripening is completed, it takes little or no part in the dormancy or afterripening of the seed.

Although some forcing agents changed the respiration and catalase activities of seeds, it was not possible to force the germination of nonafterripening juniper seeds by high temperature, alternating temperature, wounding, warm bath, dry air, removal of coats, treatment with hydrogen peroxid, mercuric chlorid, ether, carbon dioxid, oxygen, light, soil, dilute acids, dilute bases, nitrates, sulphates, or strong acids.

Freezing and thawing as such has no forcing action on the germination of juniper seeds, nor does it hasten afterripening, though it produces marked chemical changes in the seed, these being quite different from those occurring during afterripening. The juniper seed has a dormant embryo which, before germination, must afterripen, this preparatory change occurring at temperatures between 0 ± 1 and 10°, with a maximum near 5°. The changes are indicated that accompany afterripening at this optimum temperature.

In conjunction with afterripening at 5°, desiccation seems to be the only promising means of shortening this afterripening period.

The development of chlorophyll in the juniper seed and seedling was found to be independent of light, but conditioned by the temperature range. Seedlings grown at temperatures of 0 ± 1 or 30° never developed chlorophyll. Anthocyanin development in seedlings seems to depend upon relative temperature and carbohydrate supply.

A chemical and physiological study of mottling of leaves, F. M. SCHERTZ (*Bot. Gaz.*, 71 (1921), No. 2, pp. 81-130, figs. 6).—Study of the leaves of *Coleus blumei*, which tend to lose chlorophyll (or to mottle) progressively from lower leaves upward and from leaf margins inward, veinward, and baseward, shows that the chloroplasts involved lose their green color and become reduced as regards size and photosynthetic function.

Experimental investigations on birch and oak, E. S. WHITAKER (*Bot. Gaz.*, 71 (1921), No. 3, pp. 220-235, pls. 4, figs. 4).—The comparative anatomical study of existing and fossil plants has led to the conclusion that there are certain general principles which hold true, not only for a group of plants in which there is a fossil record but also for other groups in which, as is in the angiosperms, there is as yet no complete geological record. Certain general conclusions thus inductively established make it possible to apply the same principles in judging anatomical features and interpreting structural relationships in the angiosperms, in the absence of fossil record.

The first principle is based on the fact that in the course of their development organisms may pass through conditions now lost in adult life, but once possessed by the organism in its mature state. In the second place, it has been shown that certain parts of plants (as root, leaf, first annual ring, and reproductive axis) may have a different organization of tissues from the stem, which is more highly specialized. The third principle is based on the fact that upon injury certain structures and types of organization appear which are characteristic of older forms and more conservative regions of the plant.

This work is confined to those traumatic features which are connected with ray structures only, other reversioners and reactions consequent upon injury in the birch and oak being postponed.

It appears that three types of rays, aggregate, compound, and diffuse, which persist contemporaneously in *Casuarina*, are characteristic of angiospermous trees. The aggregate appears to be the more primitive one, from which the diffuse and compound have been derived by different processes of evolution.

Wound reactions in woody forms must be considered with reference to the conservative regions, the seedling structures, and the fossil record, because only those structures occurring as a consequence of injury which have parallel conditions in these parts can be regarded as true reversioners.

All reactions following wounding are not true reversioners. In general, extreme hypertrophy is not favorable to reversion.

The details of wound reaction in the birch and in the oak are different. In the birch the wound cap is large, the hypertrophy being very marked. As a consequence the traumatic or reversionary features are not found in this region, but in that part of the cylinder opposite the wound. Ables recalls marginal ray tracheids as a consequence of wounding. These are found in the regions remote from the wound and parallel the situation obtaining in the birch. In the oaks the wound cap is small and does not show hypertrophy to any marked extent. Correlated with this, reversionary features appear in the wound cap proper, in contrast to the birches.

Gametophytic development of blister rusts, J. F. ADAMS (*Bot. Gaz.*, 71 (1921), No. 2, pp. 131-137, figs. 4).—The results of examination of *Peridermium* spp. are detailed in connection with three methods observed in regard to the sequence of pycnia and aecia, or the completion of the gametophytic development on any given infected area.

Genetics (*California Sta. Rpt.* 1922, pp. 96-102, figs. 3) --In connection with investigations on the genetics of *Crepis*, E. B. Babcock has obtained about 35 species from different parts of the world, and a number of species crosses have been made for inheritance studies. J. L. Collins and Miss Mann have given an account of their studies on the hereditary and chromosome relations of a number of species hybrids of *Crepis*. R. F. Allen has made cytological examinations of the hybrids, and as a result of all these studies data have been secured that appear to have an important bearing on the taxonomic classification of the species.

A convenient thermoregulator, H. HASSELBRING (*Bot. Gaz.*, 71 (1921), No. 4, pp. 327-330, figs. 2).—A brief descriptive account is given of a compact, convenient, and adaptable thermoregulator in use for several years in the Bureau of Plant Industry, U. S. D. A.

FIELD CROPS.

[**Field crops experiments in California**] (*California Sta. Rpt.* 1922, pp. 21, 23, 24, 28-47, 49, 52, 53, 103, 116, figs. 9).—These pages report the continuation of earlier work (*E. S. R.*, 47, p. 630).

Studies of the effect of well-prepared summer fallow upon the protein content of wheat, by W. W. Mackle and J. A. Denny at the Kearney Substation, showed the wet-protein content of eight varieties to range between 32.2 and 38.5 per cent, averaging 33.5 per cent, while wheat in the region ranges from 24 to 26 per cent. Since no manures, fertilizers, or legumes were supplied, the increased protein content was probably due to the quantities of available nitrates in the soil.

J. W. Gilmore and Denny found that wheat yields in a matured rotation averaged 29.8 per cent higher than in an unmanured rotation, whereas corn

yielded 26.9 per cent higher in the unmanured rotation. The difference in the average yields of beans was slight. The experiment showed that while manure is beneficial, it should be applied only in such quantities as will undergo complete decomposition.

Average acre yields from fallowed wheat plats were 37.4 bu., and from two crops of wheat under continuous culture 48.3 bu. The value of the increase would more than offset the lower cost of the fallow.

Mexican June, with 69.1 bu. per acre, led corn varieties tested by G. W. Hendry at Davis. He reports that sunflowers yielded from 20 to 24 tons per acre, about 4 tons less than Honey sorghum and about 6 tons more than corn. Tochimington, with 2,119 lbs. of fiber per acre, led 5 hemp varieties retted by irrigation.

Observations by Hendry doubtless indicate that conspicuous clumps of tall vigorous grain standing in contrast to the shorter and less thrifty plants were caused by fallowing due to destruction of herbage by gophers on these areas in the previous year. Studies by W. F. Gericke of the effects of cutting back wheat plants gave indications that the age of the plant, the variety, the distance from the ground at which plants are cut back, and the subsequent fertilizer treatments are very important factors affecting tillering and the grain and straw yields.

In 157 cooperative tests undertaken by Hendry throughout the State, Mariout averaged 24 per cent more grain than Coast (common) barley. Mariout maintained the highest increase from Sacramento south, throughout the great valley and in southern California, especially on light soils. In the north it generally proved inferior to Coast barley, especially when fall sown on heavy soils, and was also found ill adapted to the humid coast regions and to the high mountain valleys.

Unthinned Yolo averaged 6,281 lbs. of threshed grain per acre and thinned Yolo 6,137 lbs. Plants on thinned plats were more uniform in height and appearance, thicker stalked, and carried larger individual heads than those on unthinned plats. The thinned blocks were from 10 to 18 in. shorter. Unirrigated milo was markedly reduced in yield by thinning. Irrigation during the early stages of plant development was observed to be of greater benefit to the crop and resulted in greater uniformity of growth and development than when given at later stages. Milo irrigated late put added growth in suckers and Yolo into ratoons, both of which were objectionable. Without irrigation with insufficient moisture for a normal growth, milo yielded 1,506 lbs. of seed per acre and Yolo 2,016 lbs. Milo averaged one more tiller per plant than Yolo, and when unthinned and thinned it averaged 1.7 and 0.5 more tillers per plant than unthinned and thinned Yolo. Yolo produced much fewer abortive stools than milo, even with irrigation. Chemical analysis by M. E. Jaffa and feeding tests by J. E. Dougherty show Yolo to be very similar to the other grain sorghums in composition and in palatability to poultry.

Detailed notes are included on the adaptation and behavior of mungo beans, berseem clover, Harding grass, kikuyu grass, Texas blue grass, and Rhodes grass. W. W. Mackie reports a wilt disease (*Fusarium* sp.) of the mungo bean in the Imperial Valley, which caused slight injury by inducing premature ripening. Hubam clover yielded at the rate of 3.35 tons of green hay per acre, and *Melilotus alba* 4.8 tons in comparable plantings by Hendry at Davis. The composition of the cured samples and of alfalfa taken on the same day are reported by Jaffa and H. Goss. According to Denny, the Cream cowpea excels for the locality and soil at the Kearney Substation.

Chilean, hairy Peruvian, and smooth Peruvian alfalfa seeded at the Kearney Substation by Denny produced in 7 cuttings total yields of 19.16, 19.76, and 19.98

tons per acre. The midsummer cuttings of hairy Peruvian were smaller than those of the other varieties, but it appeared to grow better during cool weather. Smooth Peruvian also led in tests by L. G. Goar in the Imperial Valley. Results in irrigation studies with alfalfa by S. H. Beckett corroborated earlier findings, indicating heavier yields but not much greater profits from frequent light applications than from a few heavier ones.

In experiments by Mackie at the Meloland Substation rice varieties seeded May 15 matured at about the same time as those sown June 11, with yields favoring the late seeding. The long-kernel or tropical group appeared better adapted and yielded higher than the short-kernelled Japan or Temperate Zone rices. Continuous flooding of Early Wataribune to control weeds was entirely successful, and gave yields superior to those obtained by intermittent flooding, which permitted weeds to nearly obscure the rice plants. The highest water temperatures appeared to favor the rice plants, enabling the best varieties to mature from 101 to 123 days after seeding. The required irrigation period was from 10 to 12 days less than the time needed for maturing the crop.

Of some 220 different species of plants collected by P. B. Kennedy in the El Dorado National Forest only 50 could be considered as having any special forage value, and 11 were poisonous or suspicious. Thirty true grasses collected are listed, and the other important plants are indicated. Forage conditions and practices on the lands of the lower San Joaquin River are also described. Grasses of mention include salt grass (*Distichlis spicata*), alkali sacaton (*Sporobolus airoides*), spike or scale grass (*Leptochloa fascicularis*), and blue-joint (*Elymus triticoides*).

Among cotton varieties tested by Hendry at Davis, Hartsville 16A exhibited least injury from Rhizoctonia, Ibaragi was earliest, and Webb and Durango were the highest in yields. In experiments with sucker cotton by Mackie and Goar in the Imperial Valley, a number of plants died with the advance in age, but the plant yield of the survivors increased. With good cultural conditions the strength and quality of the fiber was unaffected. The second-year sucker crop was the heaviest and the plants the largest and earliest to mature.

Waller and Kleinwanzleben, each with over 15 tons per acre, led sugar-beet varieties at Davis. Yields of all classes of roots except carrots were lower than in the previous season.

Selection through the choice of seeds from dominant plants of an allogamous population. R. B. ROBBINS (*Genetics*, 7 (1922), No. 5, pp. 508-512).—In selection which consists in the choice of seeds from dominant plants while no effort is made to control the source of pollen, such as carried on with corn at the Ohio Experiment Station (E. S. R., 33, p. 35), the formulas developed in this contribution from the University of Michigan show that the composition of the resulting generations will approach more and more nearly to pure dominant in character regardless of the composition of the original population if it is not all pure dominant in character. However, the approach to the limiting population decreases in rapidity in succeeding generations.

Increasing our crop yields by seed selection on the farm. R. Y. WINTERS (*North Carolina Sta. Circ.* 32 (1915), pp. 4, fig. 1).—The simple plan of selection, outlined as suitable for corn, cotton, and other crops, consists of growing annually an isolated and rogued seed patch, the original stock being from 50 or more of the best plants from the general crop. The best plants furnish the seed for the breeding patch of the next year, and the remaining seed is used for the next general crop.

Tabulated yields of plant-rows of Culpepper cotton reveal variations between 778 and 2,209 lbs. of seed cotton per acre, averaging 1,442 lbs. as compared with 1,050 lbs. from the unselected seed.

Rotation systems for hay growing, J. KEANE (*Jour. Dept. Agr. Victoria*, 19 (1921), No. 6, pp. 367-374, figs. 2).—Comparisons of systems for growing oats hay at Werribee Research Farm, from 1914 to 1920, inclusive, with an average rainfall of 20.25 in., showed the following, ranked in order of profitability and with average acre yields: (1) Hay, 2.7 tons after bare fallow; (2) hay, 2.78 tons after barley 20.2 bu. and bare fallow; (3) hay, 1.34 tons continuously; and (4) hay, 1.82 tons after barley 18.3 bu. and peas 8.5 bu.

Fertilizing seed before planting, A. DURAND (*Vie Agr. et Rurale*, 21 (1922), No. 46, pp. 361-363).—Seed of oats, wheat, and barley treated with solutions of nitrates of ammonium and of potassium before planting yielded less than untreated seed in tests at the Eure-et-Loir Station. Negative results followed the use of Fertilisa Pion Gaud with beans and barley.

Differences effected in the protein content of grain by applications of nitrogen made at different growing periods of the plants, W. F. GERICKE (*Soil Sci.*, 14 (1922), No. 9, pp. 103-109).—Turkey Red winter wheat, Texas Red oats, and rye were subjected to treatment similar to that given White Australian wheat in earlier contributions (E. S. R., 44, p. 735; 47, p. 233) from the California Station.

Excepting the treatment 109 days after planting (November 18), the time of applying sodium nitrate did not affect definitely the protein content of the winter wheat, probably partly due to the relative dormancy of the crop. Oats showed a progressive increase from 7.5 per cent of protein where nitrogen was applied at planting to 17.2 per cent with the application 109 days after planting. Treatment up to 43 days after planting did not vary the protein content of rye, whereas a progressive increase from 10.9 to 14 per cent took place with applications from 74 to 133 days. Applying sodium nitrate early or relatively late in the growing period of the plants did not noticeably affect kernel development, whereas the yield per culture was markedly influenced.

The chemical composition of grain apparently can be markedly affected by factors involved in the nutrition of the plants. It is considered that variations in the protein content of grain are not always due to unknown genetic factors, but may be definite noninheritable responses of the plant to certain conditions of its external environment.

Cereal production in Yugoslavia, L. G. MICHAEL (*U. S. Dept. Agr., Bur. Agr. Econ., Foreign Sect. Rpt.* 24 (1922), pp. 1-34).—The acreages devoted to wheat, rye, barley, oats, and corn are indicated for the component districts of the Kingdom of Yugoslavia, with discussion of agrarian and agronomic conditions, and the wheat and rye balance in each. Space is devoted to the internal and export grain trade, with statistics on population, land utilization, and comparative yields.

Cereal crop situation in Bulgaria, L. G. MICHAEL (*U. S. Dept. Agr., Bur. Agr. Econ., Foreign Sect. Rpt.* 25 (1922), pp. 1-16).—The areas under cereal crops in Bulgaria are indicated, land reform and its effects on cereal acreage are discussed, cereal exports are tabulated, the post-war wheat and rye balances are touched upon, and the cereal situation in the Kingdom in 1922 is summarized.

Storage of root crops (*California Sta. Rpt.* 1922, pp. 47, 48, fig. 1).—Mangels generally deteriorated least, sugar beets next, rutabagas a little more, and carrots the most, in a storage test at Davis, reported by J. P. Conrad. Carrots left in the field over winter sent up seed stalks in the spring earliest, starting to bloom April 15, while mangels and sugar beets produced seed stalks later and

bloomed May 16. The tests at Davis indicated that the factors influencing the keeping of roots in a dry condition were, in order of importance, ventilation, date of storing, relation of storage space to surface of ground, presence or absence of straw before dirt covering, and roofing over.

Improvement of fodder corn for Manitoba and other prairie provinces. W. SOUTHWORTH (*Sci. Agr.*, 3 (1922), No. 4, pp. 143-151, figs. 5).—An account of corn improvement work at Manitoba Agricultural College.

Mature seed corn has been produced in 5 of the 7 years ended with 1922. Preliminary comparisons indicate that Manitoba-grown seed corn may be better suited to local conditions than late corn from warmer climates. Selection with Manitoba Flint for 5 years has increased yields over 12 per cent and maturity 6 per cent, and 5 days less time from planting to husking were required. Fl seed from Manitoba Flint×Northwestern Dent gave 4,795 lbs. per acre more total crop than Northwestern Dent, the highest producing parent.

Cotton variety test, 1922, R. R. CHILDS (*Ga. Agr. Col. Circ.* 88 (1922), pp. [4]).—Piedmont Cleveland, Lightning Express, and College No. 1, with 589, 563, and 540 lbs. of lint per acre, respectively, were the highest yielders in the 1922 tests of cotton varieties. Ranked according to the total value of the crop, Lightning Express was first with \$179.59, Delfos 698 next with \$174.85, and Piedmont Cleveland third with \$174.43 per acre. Trice and Over-the-Top were outstanding among the very early varieties.

One-variety cotton communities, O. F. COOK (*U. S. Dept. Agr. Bul.* 1111 (1922), pp. 50).—An extended discussion is given concerning the one-variety cotton community. The merits of pure cotton seed (*E. S. R.*, 46, p. 229) and the disadvantages of mixed-variety production are enumerated. It is pointed out, however, that unless the organization of the industry is improved, superior varieties will have only very limited use. The methods employed heretofore in the distribution of new varieties are said to have been ineffective, and cooperation through organized communities to create new seed supply centers apparently is the only practical means of extending the use of superior varieties. Consideration of the deterioration wrought by the public gin (*E. S. R.*, 46, p. 834) and the fact that the industry is composed of gin-unit communities leads to the suggestion that the injury at the gin can be avoided by organizing a one-variety community. The existence of too many cotton varieties is pointed out, and the practice of renaming varieties is deprecated. The value of classing cotton in the field has been shown (*E. S. R.*, 44, p. 138). The different forms of organization are outlined, and comment is made on the progress in organized communities and interest in community development. Information is also included regarding communities interested in particular varieties, such as Pima, Meade, Durango, Acala, and Lone Star.

[The jute industry in India] (*Indian Jute Mills Assoc. Rpt.* 1921, pp. 211-243, pls. 4).—Tabulated statistics indicate the acreage, production, manufacture, prices, and commercial movement of jute and jute products in India, together with considerable data relative to the exportation of jute and jute products from Calcutta to various consuming centers.

Oat production in Saskatchewan, C. H. GOULDEN (*Sci. Agr.*, 3 (1922), No. 4, pp. 125-134, figs. 6).—Canada produces about 10 per cent of the world's oat crop, over one-third being grown in Saskatchewan. Besides the results of experiments with oats at the University of Saskatchewan, this article discusses the varieties of oats, their uses, place in the rotation, cultural methods, and diseases.

Banner with 66.3 bu., Gold Rain 64.4, Victory 63.8, and Ligowo with 60.6 bu. ranked first among varieties tested from 1911 to 1922, inclusive, while Gerlach,

a hull-less sort, exceeded these from 1917 to 1922. The highest average yields from Banner oats were had from May 10 seedings. Although the maximum return in rate of seeding trials was obtained in abnormally dry years from 1 bu. per acre and in very wet years from 4 bu., about 2 bu. is deemed suitable on clean land in dry sections, and from 2 to 2.5 bu. in the park belt.

Potato culture in Michigan, H. C. MOORE (*Michigan Sta. Spec. Bul. 117* (1922), pp. 32, figs. 20).—Cultural methods and field practices considered best for the production of potatoes in the State are outlined, with discussion of statistics of production, seed selection and treatment, spraying, grading, and storage. Varieties recommended include Irish Cobbler and Early Ohio of the earlies, and Late Petoskey, White Rurals, and Green Mountain of the late group.

The use of wrack in potato culture, VINCENT (*Vie Agr. et Rurale*, 21 (1922), No. 44, pp. 332-334, figs. 2).—Applied to potatoes on a sandy clay soil at Quimper, Finistère, wrack (*Fucus vesiculosus*, *F. serratus*) combined with mineral fertilizers or stable manure proved superior to manure alone or combined with mineral fertilizers. The employment of wrack in potato production in Brittany is described briefly.

Some new varieties of rice, C. E. CHAMBLISS and J. M. JENKINS (*U. S. Dept. Agr. Bul. 1127* (1923), pp. 18, pls. 4, figs. 3).—The rice plant is described, and illustrations and botanical and agronomic descriptions are given of Fortuna, Acadia, Delitus, Tokalon, Evangeline, Vintula, and Salvo, new varieties developed in cooperation with the Louisiana Stations and said to be pure line selections from the Pa Chiam, Omachi, Bertone, Carangiang, unnamed Guatemala, unnamed Ceylon, and Djember varieties, respectively. Similar data are offered regarding the Honduras, Wataribune, Blue Rose, and Shinriki varieties. Notes on culinary qualities are included.

Usually the entire plant of Delitus, Evangeline, Vintula, and Honduras matures rapidly, the leaves turning yellow as the grain ripens, whereas the stems and foliage of the other varieties described retain their green color after the grain ripens. Fortuna, Acadia, Delitus, Tokalon, Wataribune, and Shinriki are characterized by uniformity in size of seed. The seeds on the lower part of the panicles of Evangeline and Honduras often vary in size, and, when grown on poor soil, these varieties and Blue Rose often have stunted panicles with imperfect seeds. None of the varieties described shows complete resistance and Honduras is very susceptible to the rotten-neck disease caused by *Piricularia oryzae*, and all may be seriously affected thereby if left uncut too long after maturity. The conditions producing straight head did not affect Fortuna and Vintula as far as observed.

Inheritance and breeding experiments with rye, STEGLICH and H. PIEPER (*Fühling's Landw. Ztg.*, 71 (1922), No. 11-12, pp. 201-221, figs. 2).—Experiments with rye since 1895 included studies of inbreeding, effect of "new blood," color inheritance, and xenia.

Data from 14 years of inbreeding indicated that sooner or later striking evidence of degeneration appears. Doubtless individual differences may be such that many lines are slower or quicker to degenerate. A single crossing is apparently adequate to overcome the constitutional losses in inbred strains. Seed setting and luxuriance of growth were the lesser, the closer the two parents were related to one another. Selfing and close pollination were much more detrimental to plants weakened by inbreeding than with strong plants from normally pollinated stock.

In crosses of pure heritable color types in rye, green was dominant to yellow, or rather the presence of blue color in the aleurone cells was dominant to its

absence. The F_1 plants from yellow \times green had yellow and green kernels irregularly distributed in each spike with a ratio of 3:1 in each plant, and indicative of the type of segregation in the F_2 . Black color of the epidermis was likewise dominant to its absence, but is inherited independent of the blue in the aleurone cells. The black color of the kernels is traceable to a complete or partial blackening of both layers of the epidermis. Crossing black kerneled plants with pure yellow or green kernels resulted in a preponderance of black kernels in F_2 , it appearing that here too the F_1 forecasted the segregation of the F_2 .

A regular xenia formation appeared in the yellow kerneled mother plants of yellow \times green, expressing itself in a darker yellowish green tinge on the otherwise pure yellow kernels. Cases of xenia were also observed in crosses of yellow with black, and of green with black, in which a blackening of the epidermis of the yellow or green kernels of the mother plant appeared.

Tests of nitrogenous fertilizers with tobacco, E. BLANCK and F. L'PREISS (*Fuhling's Landw. Ztg.*, 71 (1922), No. 11-12, pp. 221-226).—In further comparisons of nitrogenous fertilizers on Virginia tobacco (E. S. R., 46, p. 638), plats treated with stable manure, urea, and ammonium sulphate produced approximate increases in green weight of 42, 21, and 10 per cent, respectively, over plats not treated with nitrogenous fertilizers.

Kota wheat, L. R. WALDRON, T. E. STOA, and C. E. MANGELS (*North Dakota Sta. Circ.* 19 (1922), pp. 10, figs. 3).—The characteristics of Kota have been pointed out earlier (E. S. R., 41, p. 535; 45, p. 831).

Compared with Marquis in studies by the station, Kota carried about one-tenth the rust of the latter; averaged 18.5 bu. per acre, an increase of 15.6 per cent over Marquis; and has a weaker straw, taller plant, equal maturity, harder kernel, higher test weight, greater flour yield, slightly larger loaf, slightly lower texture, and slightly better color of loaf. Kota produces a loaf of bread which is creamy to creamy yellow in color as compared to the creamy white to white loaves of Marquis.

Inspection of agricultural seeds, E. G. PROULX ET AL. (*Indiana Sta. Bul.* 264 (1923), pp. 56, fig. 1).—Tables show the purity, germination percentage, and hard seed and weed seed content of 635 official samples of agricultural seed secured from seed merchants in the State in 1922. The requirements of the seed law have been noted (E. S. R., 47, p. 138). Effective from the date of this publication is the following regulation:

"The phrase 'minimum percentage of germination' as contained in the Indiana seed law is interpreted to mean the actual percentage of the seeds that sprout or germinate at the end of the time usually allowed for germination test. In the case of leguminous seeds containing hard seeds, the actual percentage of germination should be given on the official label, and this germination percentage may be followed by the percentage of hard seeds."

Work of the seed inspection laboratory for the year 1921, F. S. HOLMES (*Maryland Sta. Bul.* 249 (1922), pp. 189-206).—Results of purity and germination tests are reported for 1,152 samples of agricultural seed and 44 samples of special seed mixtures collected during 1921.

Seed testing [in Scotland, 1920-21] (*Scot. Bd. Agr. Rpt.*, 10 (1921), pp. 55-75).—The activities of the Seed Testing Station at Edinburgh during the period ended July 31, 1921, are reported as heretofore (E. S. R., 46, p. 137). Notes are included on the purity and germination of 9,964 samples of agricultural seed tested.

HORTICULTURE.

[Horticultural investigations at the California Station] (*California Sta. Rpt. 1922*, pp. 48, 67-71, 76, 124-132, 181, figs. 3).—Various investigations conducted during the year ended June 30, 1922, are reported upon, for the most part without the inclusion of data.

A fertility test with the date conducted by W. W. Mackie and Goar indicated that nitrate of soda was beneficial both in increasing the yield and in promoting early maturity of the fruit. Barnyard manure increased the size but had no apparent effect on the quality of fruit. Ammonium sulphate gave negative results.

As indicated by measurements taken in the spring of 1922 on citrus trees set in the spring of 1917, H. J. Webber reports that there is a decided advantage in selecting large-sized nursery trees. The average top volumes in cubic feet for the large trees of the three varieties studied, namely, Washington Navel orange, Valencia orange, and Marsh grapefruit, were 190.17, 286.55, and 286.4; for the intermediate trees 118.29, 170.78, and 219.33; and for the small trees 89.65, 179.59, and 147.66, respectively. In addition, larger yields of fruit were obtained from the large trees. Observations upon citrus varieties in a test orchard at the Citrus Experiment Station showed a marked difference in the rate of growth according to variety. These differences are believed to be due to inherent characters in the variety rather than to environmental conditions. It is thought that certain varieties, such as Boone Early, Enterprise Seedless, Pineapple, Indian River, and Bessie, may be better adapted to the interior dry valleys than the Washington Navel, now largely grown but very susceptible to June drop.

As reported by L. D. Batchelor, the turning under of two cover crops, Whip-poorwill cowpeas in summer and *Melilotus indica* in winter, has stimulated a vigorous, thrifty growth in young orange trees, which in their fifth year have yielded an average of practically one box of fruit per tree. Observations by Batchelor in an old experimental orange grove which had received no fertilizer since 1919 showed that certain forms of fertilizers have a striking residual effect. All trees which received nitrogen were decidedly more productive than unfertilized trees or trees treated with potassium, or phosphoric acid. With the exception of those of the dried blood plat, the manured trees were in better condition than the trees of any of the nitrogen treated plats, yet the yield of the manured trees was probably less. The trenching method of applying manure gave no better results than broadcasting with turning under. No effect was evident from the application of ground limestone or gypsum.

In continuation of studies on the absorption of mineral nutrients by young orange trees grown under controlled conditions and supplied with the necessary mineral elements (E. S. R., 47, p. 626), H. S. Reed and A. R. C. Haas report that all parts of the trees were relatively rich in calcium, potassium, and carbonates. More sodium was found in the trunk and roots than in other parts. The ash in the rootlets of sand-grown trees was notably rich in calcium, potassium, and phosphorus. Total nitrogen, as well as total ash, was highest in the leaves and rootlets. In general, the increase of any ingredient in the nutrient solution was reflected by a proportionate increase of the same substance in the ash of the tree. In the absence of sufficient calcium, high concentrations of sodium salts led to injurious effects, and the trees failed to take up necessary qualities of magnesium.

Liberal applications of nitrogen, phosphorus, and potassium, singly or in combination, had no effect on the production of walnuts in the Santa Ana

and El Monte districts. Slight increases recorded in favor of nitrated walnut trees in Santa Paula were not sufficient to pay for the materials and labor.

In continuing his studies upon the growth of pear trees (E. S. R., 45, p. 836), Reed reports that the total amount of new growth was the same whether the mother shoots were pruned severely or slightly. Fruit spurs were generally more abundant upon unpruned mother shoots than upon those pruned the previous winter. It is believed that the growth-inhibiting substance thought to be contained in pear branches moves in a basipetal direction and is, therefore, more concentrated as the distance from the apex increases.

Rootstock investigations conducted by W. L. Howard in Europe¹ are again reviewed (E. S. R., 48, p. 236). A. H. Hendrickson, studying the affinity of stock and scion in certain deciduous fruits, found that some of the common stone fruits are difficult to bud on the strain of *Prunus davidiana* growing at the Mountain View Substation. Anatomical studies by W. P. Tufts and Heppner on the roots of fruit trees indicated that internal characters are sufficiently marked in many species to allow for the identification of many common rootstocks. Color was useful in the apricot, where the root is always beet red. Peach roots were distinguished from almond roots by the roughness and the greater protrusion of the lenticels and by the fact that the root bark is always smooth, while that of the almond is relatively rough. The bitterness and astringency of the Mazzard cherry root distinguishes it from the Mahaleb.

Fruit-bud differentiation studies with the olive by Tufts and Morrow indicated that in the Sacramento Valley differentiation occurs in the Cucco and Mission varieties prior to October 1.

A statistical study by Hendrickson of data obtained in pruning 195 French prune trees at Davis showed a strong positive correlation between weight of prunings (long system) removed in 1920 and the new length growth in 1921. A positive correlation was found between the amount of new length growth in 1920 and 1921 and the area of the cross section of the trunk. At the same time little or no correlation was found between the weight of prunings and the increase in area of the cross section of trunk the succeeding year. Determinations of the coefficient of variability for the whole orchard and for each row indicated considerable lack of uniformity.

Pruning studies with the almond, conducted by Tufts and C. L. Austin have consistently shown the greatest development of trees following the lightest pruning. Studies by J. P. Bennett on the seasonal development of leaves on long-pruned and headed apricot trees showed that during the first half of the year the effective leaf area on bearing wood of headed trees was only one-sixth to one-half the total leaf area of the tree, whereas on the long-pruned trees the range was between one-half and three-fourths. Toward the middle of the season the total leaf areas became practically equal. Further comments by F. W. Allen on the results of spacing experiments with various fruit trees (E. S. R., 47, p. 638) show that certain distances are disastrous to the welfare of fruit trees. Girdling experiments conducted by Austin were successful in increasing the amount of bloom on apple, pear, and cherry trees, but not on almond, apricot, peach, and plum. Contrary to expectation, less than 2 per cent of the stone fruits were killed by the girdling operations.

Hendrickson found in plum pollination studies that the inclosure of two compatible varieties within a mosquito-net tent containing a hive of bees resulted in heavier sets of fruit than on trees exposed to chance pollination. E. L. Overholser and Cameron, in reporting the Gravenstein apple as practically self-sterile, stated that while Delicious proved the best pollinizer for this variety in 1921 and 1922, Yellow Newtown and Esopus were also satisfactory. Jonathan proved to be the best pollinizer for King. Namlkawa

observed that the pollen tubes in self-pollinated, emasculated Bellflower apples grew down along the outside of the style and entered the ovary through the cavities occurring at the base of the style. The behavior of the pollen tubes in cross-pollinated apple blossoms was essentially the same.

Tufts and G. L. Philp, reporting on fertility studies with pear varieties in the Sacramento Valley and Sierra Nevada foothills and with cherry varieties in Sonoma County, state that although profitable crops are secured in the case of self-pollinated Bartlett pears in the Sacramento Valley, much better yields result from cross-pollination. In the Sierra foothills the Bartlett is self-sterile. Any pear variety blooming coincident with the Bartlett proved adequate as a pollinizer. Pollination tests by French with eight apricot varieties showed that although all were self-fertile, the Royal set much heavier when pollinated with Moorpark.

Storage studies by De Villiers with the pear indicated that fruits held in the vicinity of 35° C. (95° F.) retained their original firmness and greenness from 14 to 21 days longer than fruits kept at ordinary room temperatures. This phenomena is attributed to the inhibitory effect of high temperatures on pectosinase, the enzym which results in the dissolution of the cementing material between the cell walls. The optimum temperature for rapid ripening of the pear ranged between 20 and 30° (68 and 86° F.). Bjarnason found that figs when placed in water, in sirup, or when crushed with or without sugar could be kept for one year at 10° F. without noticeable deterioration. Latimer reports briefly on a storage test with pear varieties. Overholser and Cameron found that the internal browning of the Yellow Newtown apple may be controlled by proper pruning practices, early harvesting, and storage at 40 to 45° F. Hodgson reports that avocados keep best at 40° F. Overholser and Latimer found that pears gathered just when they attain their maximum size keep better than more immature fruits. Observations on the comparative keeping quality of crossed and selfed Bartlett and Winter Nelis pears showed that although the crossed fruits reached an edible condition two or three weeks earlier than the selfed, there was practically no difference in the length of the storage period in that the selfed fruits were harvested later. Brief comments are made on the storage of jujubes and persimmons.

Orchard heaters distributed at the rate of 100 per acre were able to raise the temperature of the surrounding air by 4 to 5°. It was found that apricots the size of small marbles could withstand a temperature of 30° for a period not to exceed 30 minutes.

The final results of pruning investigations with the Mission olive at Davis showed that trees unpruned during their first five years grew 10 times as large as trees severely pruned each winter. At the same time, the unpruned trees were the better shape and commenced to fruit earlier; in fact, just 61 months after planting 75 per cent of the unpruned trees were blooming profusely.

Inheritance in the summer squash, E. W. SINNOTT and G. B. DUBHAM (*Jour. Heredity*, 13 (1922), No. 4, pp. 177-186, figs. 2).—Self-pollination and selection studies conducted over a period of three years, 1916-1918, at the Connecticut Storrs Experiment Station resulted in the isolation of several strains of summer squash, *Cucurbita pepo*, which appeared so nearly true that the authors, accepting them as essentially homozygous, utilized them in crossing experiments to determine the inheritance of various important characters. White color was found dominant over yellow and yellow over green in the surface color of fruits. Solid color of fruit was in most instances dominant to striping. Wartiness was found dominant over smoothness, disk shape proved dominant over spherical shape, white flesh color was usually dominant over

cream and salmon, and single blossom and scars tended to be dominant over double. Evidence was obtained to indicate that the habit of vine; shape and arrangement of leaves; number and character of teeth; type of border; furrowing of surface; various shapes; size of seed chamber; size, shape, and color of seed; depth of blossom end scar; size and yield of fruit; and miscellaneous other characters are heritable.

Fruit industry and trade of Chile (*U. S. Dept. Agr., Bur. Agr. Econ., Foreign Sect. Rpt. 23* (1922), pp. 1+19).—This is a mimeographed report based on data submitted by S. R. Thompson, the American vice consul at Valparaiso, Chile, and on statistics by the same author published elsewhere.¹ Although prepared largely from a trade standpoint, considerable information is given concerning the status of fruit production in Chile. The grape and the peach were found to be the most satisfactory fruits, although the wide range in latitude allows for the culture of most all kinds, from subtropical to Temperate Zone species. As a whole, fruit growing in Chile was found to be in a crude state, most of the fruit being produced in gardens or small isolated orchards. Trial shipments of fruit to the United States have been successful, but it is believed that production operations will have to be materially improved before Chile will become an important exporting nation.

Pruning fruit trees, R. E. MARSHALL (*Michigan Sta. Spec. Bul. 118* (1922), pp. 3-39, figs. 39).—Following a general discussion of the principles and practices of pruning fruit trees, specific directions are given for the apple, peach, pear, cherry, and plum.

Review of the 1921-22 British apple market, E. A. FOLEY (*U. S. Dept. Agr., [Bur. Agr. Econ., Foreign Sect. Rpt. 16]* (1922), pp. 1+48).—This mimeographed report presenting observations obtained as a result of a careful study of the marketing of American apples in Great Britain shows that, although sales were quite satisfactory during the period of the study, they might at all times be stimulated by better attention, at point of origin, to quality of fruit and better distribution of shipments.

The American apple season in Great Britain is necessarily short, filling the interim between the exhaustion of native fruit and the arrival of Australian and South African imports. Cold storage facilities are inadequate for holding fruit, which is, therefore, placed directly upon the market irrespective of supply and demand. The English trade being adverse to repacked fruit, initial quality is of prime importance. The greater part of the American apples are sold at auction, yet there are many reliable commission houses. Glasgow is considered the best British market for American fruit.

Statistical data on fruit and vegetable imports into the United Kingdom in 1920, on the value of fresh produce grown in England and Wales, and on the principal fruits sold in the United Kingdom, their origin, and season in market are appended in tabular form.

The relation of tree type to productivity in the apple, K. SAX and J. W. GOWEN (*Maine Sta. Bul. 305* (1922), pp. 20, pls. 4, figs. 3).—This paper, the substance of which has been previously noted (*E. S. R.*, 46, p. 841), deals with a biometrical study with the apple, in which it was found that Ben Davis trees of the same age and grown under apparently identical conditions varied notably in their productive capacities.

Some relations between circumference and weight and between root and top growth of young apple trees, A. J. HEINICKE (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 222-227).—Records taken in the spring of 1921 upon the growth development of McIntosh trees, so carefully selected at the time of planting,

¹ *Bul. Pan Amer. Union*, 55 (1922), No. 3, pp. 277-280.

1917, that the average vigor and coefficient of variability were the same in 30 plats of 20 trees each, showed wide variations in weight between trees of the same circumference. The individual weights (tops and roots) of 20 trees having a common circumference of 14 cm. (5.5 in.) ranged from 4.170 to 7.860 gm. (9.2 to 17.4 lbs.). In this particular lot of trees computations showed that the weight had increased approximately 7.3 times, while the circumference had doubled.

In arranging the trees of the various plats according to weight and averaging them in groups of 5, the calculated weight corresponding to average circumference ranged from 0.66 to 1.26 times the actual weight and in 75 of the 108 groups was within 10 per cent of the true value. Much greater departures from actual weight were obtained when the 20 trees of a single plat were grouped in fives, leading the author to conclude that circumference measurements are only reliable as a measure of small differences when rather large numbers of approximately similar trees are involved.

The value obtained by dividing the weight of top by the weight of the root ranged from 0.89 to 4.44, the average being approximately 2.00. In dividing the 20 trees of each plat into deep and shallow rooted groups of 10 each, it was found that in every plat the more deeply planted trees had the smaller root system in relation to the top. A summation of the data showed that in trees having roots of equal size the root system of deeply planted trees produced a top about 22 per cent heavier than that of the shallow planted trees. The total weight of the tree was not affected by depth of planting.

A study of exceptions indicated that the height and spread of the tops also affected the relation between top and root. Of the 129 instances in which the ratio was too high for the depth, 30 per cent were exceptionally tall, narrow trees, and 22 per cent made more than average growth in 1920. Of the 89 instances in which the ratio seemed too low for the depth, 24 per cent were short, spreading trees, and 33 per cent had made subnormal growth in 1920.

The average ratios between root and top for the 20 trees in each of the sod plats were 1.88, 1.8, and 1.54, as compared with 2.11, 1.98, and 1.69 for corresponding cultivated plats. The addition of nitrogen to sod reversed the results, the ratios for nitrogen-treated sod plats being 2.09, 2.35, 2.15, and 2.26, as compared with 1.81, 2.13, 2.09, and 1.77 for corresponding cultivated areas. Cultivation apparently supplied the necessary growth-producing materials which enabled the formation of a many-branched, round-headed tree as compared with the small spindling growth of sod-grown trees invigorated with nitrate of soda.

The pears of New York, U. P. HEDRICK, G. H. HOWE, O. M. TAYLOR, E. H. FRANCIS, and H. B. TUKEY (*New York Sta. Rpt. 1921, pt. 2, pp. XI+636, pls. 82*).—Distinguished by the usual admirable color illustrations of important species and varieties, this monograph, sixth in a series (*E. S. R.*, 38, p. 42) upon fruits grown in New York State, is devoted primarily to a consideration of varieties, their history, economic value, description, and synonymy. Comprehensive information is presented upon the history and uses of the pear, species and their characters, and culture in the United States in general and in New York in particular. In brief, this book constitutes a summary of the past and present knowledge of the cultivated pear. Bibliographical sketches of Manning, Wilder, Barry, Ellwanger, and other pioneers who have rendered conspicuous service to pear culture in America are included in the form of footnotes.

Keeping pears sound, E. L. OVERHOLSER (*Calif. Countryman*, 8 (1922), No. 7, pp. 3, 4, figs. 2).—Of three important factors concerned in the keeping of pears, namely, manner of pollination, degree of maturity at time of harvest, and temperature of storage chambers, the first two factors are shown to be of more importance than is usually accepted.

A comparative study of Bartlett pears developed from self- and cross-pollinated blooms indicated that cross-pollination induced earlier maturity of the fruit and thereby affected the length of the storage period. However, when fruits in the same stage of ripening were compared, the effect of pollination was insignificant.

That the time of picking has an important bearing on the life of the fruit in storage was indicated in a test of Hardy pears gathered at different intervals—August 29, September 1, 10, and 21, and October 3—the fruits keeping 39, 75, 81, 95, and 52 days, respectively. The fruits of the first three pickings wilted badly, while those of the fourth harvest kept best. Emphasizing the difficulty of defining the proper stage of maturity, the author suggests that the time when the deep green color of immature fruits assumes a faint yellowish tinge is a fairly reliable indication of picking maturity.

The relation of temperature was shown in tests with Comice pears, which kept in good condition for 138 days at 30° F., 125 days at 32° F., and 107 days at 36°. Immature fruits, on the other hand, wilted less, developed less scald, and attained a better quality when held at 36°. It is suggested that scald may be reduced by harvesting fruit at the proper stage, prompt removal to storage chambers, adequate ventilation in storage, and wrapping the individuals in odorless oil-impregnated wrappers.

Tabulated data are presented for 38 varieties showing the average picking date and average length of life in storage.

Influence of grape training on fruit production, E. C. AUCHTER and W. R. BALLARD (*Maryland Sta. Bul.* 250 (1922), pp. 207–234, figs. 22).—This bulletin, consisting for the most part of information relative to various types of grape training, also briefly comments upon the results of a pruning experiment in a vineyard established on the station grounds in 1911. Five systems of training, namely, (1) Munson, (2) two cane Kniffin, (3) four cane Kniffin, (4) two wire umbrella, and (5) fan, were compared on six varieties planted 8 by 8 ft. Computed acre yields based on the average yield of 20 vines each of three varieties—Concord, Worden, and Lutie—show that the four cane Kniffin system was the most satisfactory. The Munson system, although resulting in good yields, is not deemed as useful as the four cane Kniffin, in that the trellis is expensive to erect, and pruning, harvesting, and spraying operations are rather difficult. The average yields per acre for the three varieties as a whole, grouped according to treatments, were as follows: Four cane Kniffin, 4.47 tons; Munson, 4.32; fan, 3.82; two wire umbrella, 3.44; and two cane Kniffin, 3.11 tons.

The rôle of the European grape (*Vitis vinifera*) in the origination of American varieties, H. B. TUKEY (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 30–36).—Careful study leads the author to believe that a greater proportion of American grapes contain *V. vinifera* parentage than was asserted in *The Grapes of New York* (E. S. R., 20, p. 940), wherein of 204 important varieties 54 per cent were thought to contain, and 10 per cent likely to contain European ancestry. It is suggested that varieties belonging to *V. aestivalis bourquiniana* probably owe their quality to an infusion of *V. vinifera* parentage. Certain characters, namely, quality, round or oval shape of berry, adherence of berry, and long keeping quality of fruit, considered indicative of *V. vinifera* parentage, were found in many American varieties hitherto believed to be of strictly American origin. An examination of field records taken on 23 Concord seed-

lings, obtained by self-pollination, showed two with round to oval berries, one with vinous flavor, one with meaty flesh, and three with berries strongly adherent, from which evidence it is deemed highly probable that the Concord contains both *V. labrusca* and *V. vinifera* ancestry.

Grape pests and their control, K. MÜLLER (*Rebschädlinge und Ihre Neuzeltliche Bekämpfung. Karlsruher i. B.: G. Braunische Hofbuchdruck. u. Verlag, 1922, 2. ed., rev., pp. [6]+213, pls. 2, figs. 70*).—A revised edition of a previously noted work (E. S. R., 42, p. 238), in which is included a chapter (pp. 172–185) on the breeding of the grape.

Cranberry growing in New Jersey, C. S. BECKWITH (*New Jersey Stat. Circ. 144 (1922), pp. 39, figs. 28*).—This circular presents constructive information relative to varieties, soils, preparation of bogs, planting, harvesting, storehouses, sorting and packing, fertilizers, insects, diseases, and frost and fire prevention. Special attention is paid to the subject of water supply, with information concerning sources, necessity of adequate supplies, standard systems, and construction of dams, canals, ditches, and gates.

The almond industry in Italy and Spain, E. A. FOLEY (*U. S. Dept. Agr., Bur. Agr. Econ., Foreign Sect. Rpt. 22 (1922), pp. 2+58*).—Although largely of an economic nature, dealing with grading, marketing, and exporting features, this mimeographic report contains considerable information relative to the location of almond orchards and the character of production in different sections of the Mediterranean area.

A historic orange tree, B. T. GALLOWAY (*Jour. Heredity, 13 (1922), No. 4, pp. 163–166, figs. 2*).—A brief account dealing with the introduction of the navel orange into the United States, and commenting upon the erection of a memorial tablet in honor of the planter of the first navel orange trees in California.

FORESTRY.

Forestry, A. BÜHLER (*Der Waldbau. Stuttgart: Eugen Ulmer, 1918, vol. 1, pp. XII+662, figs. 10; 1922, vol. 2, pp. XVI+679, pl. 1, figs. 11*).—A German text and reference book, based on results obtained by various forest research stations and upon practical experience.

An investigation into the relation between height growth of trees and meteorological conditions, W. E. HILEY and N. CUNLIFF (*Oxford Forestry Mem. 1 (1922), pp. 19, pls. 3*).—This contribution from the School of Forestry, University of Oxford, relates to a study of the factors influencing the rate of growth in forest trees.

Believing that height increment is a more accurate record of the rate of growth of trees than is the width of the annual rings, measurements were taken every few days during the summers of 1920 and 1921 upon the height increment of vigorous young trees of Sitka spruce, European larch, Corsican pine, and other species. Data were also obtained on the effect upon growth development of removing the top inch of soil about the base of trees and of cutting halfway through the base of the main stem.

It was observed that the conifers studied could be arranged in three distinct groups in respect to time of maximum growth: (1) Corsican and western yellow pines at the end of May; (2) Sitka spruce and Douglas and lowland firs in the latter part of June; and (3) European and Japanese larches from two to four weeks later than the other conifers. Correlation coefficients calculated between daily height increments and various important climatic factors indicated that temperature is by far the most important factor in de-

termining variations in the rate of growth. In Corsican pine the coefficient of correlation between height increment and maximum shade temperature was $+0.88 \pm 0.03$. In the larch the correlation between increment and temperature was negligible. Apparently a mean shade temperature above 66° F. depressed growth in this species, since in 1920 when the mean temperature did not rise above 66° and the water supply was abundant a strong positive correlation was recorded. The hours of sunshine and the amount of wind had comparatively slight effect. The removal of the top soil from about the base of the tree was more effective in limiting growth in the case of the larch and the Sitka spruce than was the partial cutting of the main stem, while in the Corsican pine the reverse was true. The treated trees showed daily variations similar to those observed in the control trees.

Contribution to the knowledge of the genus *Populus*, J. GRAF (*Beiträge zur Kenntnis der Gattung Populus. Inaug. Diss., Univ. Frankfurt on the Main, 1921, pp. 52, pls. 2, figs. 10*).—This is a technical report of microscopical studies upon the new growth and the leaf and flower bud development of several species of *Populus* growing in the vicinity of Frankfurt on the Main, Germany. It was found that both the male and female flower buds are differentiated in July of the preceding year. The male buds were distinguished from the female by greater thickness and length.

[Forestry investigations at the California Station] (*California Sta. Rpt. 1922, pp. 88-95, figs. 4*).—A progress report (E. S. R., 47, p. 643) upon investigations conducted during the year ended June 30, 1922.

W. Metcalf found a wide range in the number of seeds per pound for *Sequoia*, from less than 100,000 to over 300,000. Of several lots of *Sequoia* seed tested for viability, the best gave a final germination of 32 per cent in 90 days in a standard 20° C. germination chamber, while the majority of the lots ranged between 15 and 18 per cent. Seed taken from 7 and 10-year-old trees gave respective germinations of 2 and 16 per cent, while that obtained from trees 1,000 to 1,600 years of age failed to germinate.

Redwood seedlings grown from seed sown in late November developed much more rapidly during the first year than plants obtained from March and April sowings. The latter, despite their inferior size, were able to survive under field conditions. An examination by Metcalf of the experimental planting on cut-over redwood land in Mendocino County showed a fairly high percentage of survival in all species, ranging from 100 per cent in *Acer platanoides* to 30.3 in *Fraxinus americana*.

Observations on the effect of exposure upon survival of planted seedlings showed no significant difference in favor of either a northern or a southern slope. However, in the case of direct seeding much better success was obtained on the northern aspect. Measurements taken by Metcalf and E. Fritz in a grove of second growth redwood located on a fertile soil in Mendocino County indicated that this species is capable of making a very rapid growth under favorable conditions. In their fifty-eighth year of life some of the trees had attained heights of over 150 ft. with diameters of 37 in. Measurements on a sample acre, details of which are presented in the text, showed a content of over 100,000 bd. ft. Even on relatively poor sites redwood was found to produce heavy yields.

Tests conducted by Metcalf with California nutmeg seeds showed that a long time is required for the germination of this species. Seeds planted in beds in December, 1920, did not begin to germinate until December, 1921, and were not actively germinating until March, 1922, 14 months after planting. Seeds with cracked coats failed to germinate at all, and no success was attained in at-

tempting to hasten germination by freezing, heating, or soaking. As emphasized by Fritz, nutmeg lumber is as durable as redwood or cedar, and because of its soft texture and lack of warping is valuable for cabinet making and for other highly specialized purposes. It is believed that the comparative rarity of the tree may be accounted for by the dioecious character of the blossoms.

Time studies of logging operations (E. S. R., 47, p. 540) and the preparation of white fir volume tables (E. S. R., 45, p. 838) are again discussed.

Reports of the director of the National Park Service to the Secretary of the Interior for the fiscal years ended June 30, 1921 and June 30, 1922, S. T. MATHER and A. B. CAMMERER (*U. S. Dept. Int., Rpts. Dir. Natl. Park Serv., 1921, pp. 306, pls. 13, fig. 1; 1922, pp. 173, pls. 12, fig. 1*).—These are the usual annual reports (E. S. R., 44, p. 641), containing information relating to the development of the national parks, with statistical information relative to the number of visitors, construction activities, etc., appended in tabular form.

Report of the director of forests for the six months ended December 31, 1921, E. H. F. SWAIN (*Queensland Dept. Pub. Lands, Rpt. Dir. Forests, 1921, pp. 17*).—An administrative report for the six-months period ended December 31, 1921 (E. S. R., 46, p. 340), presenting information relative to silviculture, forest protection, surveys, organization, revenues, and expenditures.

Afforestation in Korea [Chosen], P. M. ROXBY (*Scot. Geogr. Mag.*, 39 (1923), No. 1, pp. 3-6, figs. 2).—A brief article of a general nature describing the extensive and successful efforts on the part of the Japanese Government in afforesting the denuded highlands of Chosen. It is estimated that about 150,000,000 seedlings are being set each year.

The forest resources of the Far Eastern Republic (Washington, D. C.: *Spec. Deleg. Far East. Repub.*, 1922, pp. 12, pl. 1).—A brief statement concerning the extent, distribution, composition, and expected use of the forests of that section of Siberia known as the Far Eastern Republic.

DISEASES OF PLANTS.

Plant pathology (*California Sta. Rpt. 1922, pp. 118-124, 132-134, 135-138, figs. 3*).—B. A. Rudolph, studying the brown rot of apricots caused by *Sclerotinia cinerea*, has found that the critical or strategic period of spraying with Bordeaux mixture is in the spring, just before and during the blooming period. A strong Bordeaux mixture, 7-8-50, has proved more effective for the control of brown rot of apricots than the standard mixture. Lime sulphur is said to seriously damage apricots, and on this account it is not recommended.

A bud dying of apricots that is not due to parasitic attack but is apparently connected with the nutritional and growth relations is described by W. T. Horne.

E. H. Smith reported that brown rot (*Pythiacystis*) may infect the crown of the roots of stone fruit trees 7 or 8 years old, provided the fungus comes in contact with a cut or bruise on the bark when soil and moisture conditions are normal. A disease of pear trees similar to the eastern rough bark on apples caused by *Phomopsis mali* is reported, and a brief account is given of the spotting of the bark in the fruiting wood of peach, due to the bacterial spot organism.

In an account of some strawberry diseases Horne describes a disease of strawberry the cause of which is not definitely determined. Infected plants show abnormal growth of dwarf leaves and a generally unthrifty condition.

E. H. Phillips and E. H. Smith, studying fig diseases, have found that fig smut is apparently transmitted by insects, and the control of this disease is largely an entomological one.

Notes are given by R. E. Smith on the improvement of Nicodust, which is said to be becoming quite extensively used in California.

For the control of pear blight cankers L. H. Day conducted a series of experiments testing the scarification method frequently recommended. This consists of the removal of a thin layer of the outer bark over the infected area before the disease has penetrated to the cambium, and then applying a disinfectant that will not injure the exposed healthy bark. A few trees were treated in this manner in 1921, but the results were so inconclusive that they were repeated on a larger scale in 1922, a large number of disinfectants being tested. Formaldehyde, 37.3 per cent, gave results that are quite promising for its further use, and caustic cresol soaps also gave favorable results. Formaldehyde is said to have given 90 per cent control of semiactive hold-over cankers during the winter, but results of treatment after resumption of growth were not so promising.

A. H. Hendrickson is reported to have successfully used ferrous sulphate applied in contact with the roots of pear trees for the cure of chlorosis.

W. P. Tufts and Day tested the scarification method mentioned above for the control of bacterial gummosis of stone fruits, and found that 1 part formaldehyde to 5 parts of 50 per cent wood alcohol gave promise in the control of the disease on apricots and almond trees. With the cherry and plum trees, this concentration killed the cambium, but it was thought that 1 part formaldehyde to 10 parts water would be safe to use with these species.

A brief account is given of an experiment by Hendrickson on the control of Armillaria by the isolation of trees with barriers composed of concrete extending to depths beyond where the crossing roots are found. A number of species of pear stock planted in diseased areas in connection with this experiment have remained in a healthy condition for a period of two years. *Prunus davidiana* was found susceptible to attack, and it is said that this species can not be recommended as an Armillaria-resistant stock.

J. P. Bennett has carried on some experiments on the respiration of potatoes in relation to the occurrence of blackheart in storage, from which it appears that the rate of respiration decreases with decreasing temperature from 40 to 5° C., and then increases from 5 to 0°. The temperature-time-oxygen relation in the production of blackheart appeared to be fairly definite. The injury leading to the development of blackheart is believed to be due to anaerobic processes in the tissues.

[Plant disease investigations at the Citrus Experiment Station] (*California Sta. Rpt. 1922, pp. 72-75, 76, 77*).—Comparisons have been made by H. S. Fawcett and Camp between *Bacterium citriputeale*, the cause of black pit of citrus fruits, and *B. citrarefaciens*, the cause of citrus blast. It was found that the organisms have the same reaction in ordinary culture media, as well as presenting the same reaction of H-ion concentration, and when used in inoculation tests they produce identical lesions.

The internal decline of lemons investigated by E. T. Bartholomew showed that leaves may draw water from the fruits to such an extent that the fruits may decrease in size, that the excessive withdrawal of water by the leaves may cause temporary or permanent cessation of growth of the fruits, that the rate of increase in acidity and percentage of water is comparatively small after the lemons have reached a diameter of 4 cm. (1.6 in.), and that there is practically no difference in the water content or in true acidity of the juice between the two ends of a normal lemon, while those showing a decline may have as much

as 30 per cent less water in the blossom-end than in the stem-end half of the fruit. Experimental plats and other investigations have shown that the internal decline of lemons is probably brought about by water relation, and that the trouble does not progress and spread in the tissues after the lemons are removed from the tree.

While studying the internal decline of lemons Bartholomew found a black discoloration and breaking down of lemon fruits in storage that is considered due to a species of *Alternaria*.

From an examination of shellbark of lemon trees Fawcett has concluded that a fungus may be a contributing factor in this respect.

C. O. Smith has continued studies on walnut bacteriosis, and has demonstrated that pollen may carry the organism producing the disease. Tests of commercial varieties of English walnut to determine the resistance to blight have shown but little difference, and any apparent resistance is believed to be due to a lack of inoculation rather than to a resistant character of the tree.

J. T. Barrett and L. D. Batchelor investigated the cause and distribution of crown rot of walnuts and found that both crown and roots may be involved, the infection taking place in the crown first, then spreading to the roots. This disease is said to be serious in two sections in southern California, and it also occurs on the black walnut root (*Juglans californica*).

Smith reports a study of the resistance of *Prunus* stocks to crown gall. *P. mume* has thus far shown a high resistance to artificial inoculations.

Barrett reports that Bordeaux mixture has given promising results for the control of bacterial gummosis of stone fruits.

Fawcett has studied the effect of temperature on parasitic organisms, most of the investigations having been done with *Pythiacystis citrophthora*, the cause of brown rot. It has been found that this decay can be prevented on fruit by washing it in water at 115° F. for a minute or more, or at 120 or 125° for one-half minute. The development of brown rot was prevented on heavily infected fruits stored at 60° if the fruit was treated with water at 115° for two minutes at any time within eight hours from the time of infection.

Smith found in inoculation experiments with the olive knot organism that characteristic lesions were produced on *Adelia acuminata*, *Chionanthus virginica*, *Fraxinus velutina*, *F. floribunda*, *Jasminum primulinum*, and *Osmanthus aquifolium*, although the knots were not so large as in check inoculations on the olive.

H. J. Quayle and H. Knight report that corrosive sublimate at a strength of 1:2,000 is the most satisfactory method of treating fumigation tents for the prevention of mildew.

Batchelor has given an account of a variety of walnut which is said to combine many of the good qualities of some of the leading commercial varieties, and as it blooms late in the season avoids liability to spring frost.

An investigation of frost injury to young figs was carried on by J. C. Johnston, and it was found that damage was practically confined to fig trees not over 5 years of age. Severely pruned trees showed more injury than unpruned trees under the same conditions.

A study was also made of the splitting and souring of figs, particular attention being paid to the structure relation of the fruit to the susceptibility of splitting. The kinds of sugar, the nature of the colloidal material, and the nature of the enzymes occurring in the fruit are also said to have an important bearing on this trouble.

Lightning injury to potato and cabbage, C. R. OXTON (*Phytopathology*, 11 (1921), No. 2, pp. 96-98, fig. 1).—Observations are recorded as made August 29, 1919, on potato plants supposedly struck by lightning at Gerard, Pa., nine days

previously, and as made August 1 of that year on headed cabbage showing much the same symptoms. Some of these are indicated as probably diagnostic, in particular the decrease in severity from center to circumference of the area affected, also the hollow and whitened condition of the pith a little above the ground.

Effect of external and internal factors on the germination of fungus spores, W. L. DORAN (*Bul. Torrey Bot. Club*, 49 (1922), No. 11, pp. 313-340, figs. 2; also *New Hampshire Sta. Sci. Contrib.* 19 (1922), pp. 313-340, figs. 2).—In connection with investigations on the life history of several species of fungi, studies are reported on the germination of conidia of *Ventura inaequalis* and *Sclerotinia fructigena*; spores of *Alternaria solani*, *Botrytis cinerea*, and *Rhizopus nigricans*; aeciospores of *Gymnosporangium clavipes*; and teliospores of *Puccinia malvacearum*.

It was found that spores of parasitic fungi germinate better when obtained from the living host than when grown on artificial media. Mature spores germinate through a wider range of environmental conditions than immature ones, and freshly mature spores through a wider range of environmental conditions than old spores. As the spores age, viability at first decreases sharply, after which it is only gradually lost. Longevity of spores is said to be dependent upon conditions of storage after detachment from the host, and moisture is of more importance than temperature in its effect on the length of the life of the spore. Considerable difference was observed on the germination of different kinds of spores under maximum and minimum temperature conditions, and the nearer all conditions are to the optimum the shorter will be the time required for spore germination. Competition or crowding is said to inhibit spore germination, probably through an insufficient oxygen supply. Spores of the different fungi studied germinated in either light or darkness, and precipitated moisture was found to be unnecessary for the germination of some spores if water vapor was available.

Studies on mosaic, B. T. DICKSON (*Abs. in Phytopathology*, 11 (1921), No. 4, p. 202).—Mosaic is now known in 30 genera of 10 families and mosaic-like diseases in 8 genera of 5 families. True mosaic histological symptoms are hyperplasia of palisade parenchyma in light areas, reduction of chlorophyll content in those areas, and, generally, an increase in trichomes and glandular hairs. On the other hand, there is frequently a hypertrophy of palisade tissue in dark areas due to hyperplasia. There is definitely less carbohydrate in the light parts. Mosaic of *Vicia faba* is described, and raspberry mosaic is differentiated from yellows. No mosaic of the Cucurbitaceae has been found in Quebec by the author.

On the use of the acetates of copper as fungicides, O. BUTLER and T. O. SMITH (*Phytopathology*, 12 (1922), No. 6, pp. 279-289, fig. 1; also *New Hampshire Sta. Sci. Contrib.* 20 (1922), pp. 279-289, fig. 1).—The authors claim that acetates of copper are excellent fungicides and deserve special consideration when a colorless deposit is desired. They are said to be less injurious to the plant than the cuprammoniums and are preferred to them.

Based upon studies of neutral and basic acetates of copper sprayed on glass plates, dried, and subjected to artificial rain, basic acetate of copper was found to adhere much better than the neutral acetate of copper. An addition of gelatin to the solution was found to increase the adhesiveness of the acetates very markedly, the greatest benefit occurring to the neutral acetates.

Formulas are presented for two strengths of copper acetate, the weaker being intended for use when the acetate is employed in place of cuprammonium, and the stronger when it is desired to use a colorless fungicide in lieu of Bordeaux mixture.

[**Cereal disease investigations in California**] (*California Sta. Rpt. 1922*, pp. 24-28).—W. W. Mackie and Briggs report that copper carbonate dust proved very effective for the control of bunt on wheat. Tests made in the greenhouse showed that wheat so treated sprouted quicker and made 25 per cent more weight of seedlings in six weeks than seed dipped in chemical solutions.

Notes are given on hybrid wheats resistant to stem rust, immunity to bunt in selections of wheat, wheat varieties resistant to stem rust and leaf rust, and Mackie and P. B. Kennedy report the occurrence of stripe rust on a considerable number of species of grasses.

Mackie claims that resistance to barley scald (*Rhynchosporium secalis*) is maintained in a number of varieties under investigation. It has been found that barley scald may be controlled by time of seeding, little or no disease appearing on sowings made after January 20.

A modification of the concentrated formaldehyde method of seed treatment, C. W. HUNGERFORD (*Phytopathology*, 11 (1921), No 3, pp. 149, 150).—The concentrated formaldehyde method of seed treatment as proposed by Haskell (E. S. R., 39, p. 248) and as commonly used, employing equal parts of 40 per cent formaldehyde and water at the rate of 1 qt. to 50 bu. of oats, being objectionable on account of throat irritation during its application, a modification of the plan has been tested out for three years and has proved satisfactory. The treatment consists simply in using 10 parts water to 1 of formaldehyde. The solution is applied more evenly, does not necessitate drying, and is free from disagreeable effects even when applied in a closed room.

Preliminary experiments on injury to wheat from seed treatment in Washington, G. L. ZUNDEL (*Phytopathology*, 11 (1921), No 2, p. 103).—Samples of wheat from many localities in the Pacific Northwest, especially from Washington, were treated with a standard copper sulphate solution (1 lb. to 5 gal. of water) for 10 minutes. The resulting seed injury varied from 12 to over 60 per cent, but hand-threshed wheat was very slightly injured. When treated with formaldehyde solution, 1.40, the injury ranged from 8 to 80 per cent, varying with the seed lot of a given variety and with the manner in which the seed was threshed. When the high speed cylinder machines are used very dry grain sustains numerous small cracks that allow the fungicide to reach the germ and cause injury. Wheat dipped in a lime solution for from 3 to 5 minutes after treating with copper sulphate sustains but little injury, and less after formaldehyde. In each of 5 field tests beneficial results were obtained by the use of the lime bath.

The bacterial blight of the bean: A systemic disease, W. H. BURKHOLDER (*Phytopathology*, 11 (1921), No. 2, pp. 61-69).—Bacterial blight or bacteriosis (*Bacterium phaseoli*) mentioned previously (E. S. R., 37, p. 840), a common and widely distributed disease, has increased until it is one of the serious bean diseases present in all bean-producing sections, causing crop losses estimated at 3 to 8 per cent. It is of more importance according to field surveys than anthracnose in New York. It is believed that the systemic nature of bacterial blight, evidence of which, as gathered in New York State and as here presented, accounts in large measure for the various anomalies met with in this disease. Unlike many of the parasitic plant diseases there are different symptoms, depending upon a variety of conditions not clearly understood. Both usual and unusual symptoms are described in some detail, as is also the systemic invasion which probably occurs wherever the disease is found. Probably in a large majority of cases the hilum-infected seeds carry the bacteria over winter.

Experimentation is detailed as showing the ability of *B. phaseoli* to travel by way of the vascular system of the cotyledonary node to the leaves of the

bean plant and there produce lesions; also as proving the systemic nature of the bacterial blight and the capability of the hilum-infected seeds to produce blighted plants.

When inoculation experiments were conducted with bacteria taken from pure cultures, negative results were very frequently obtained. It is thought that *B. phaseoli* probably loses its virulence very rapidly in culture. In making inoculations with the organism from infected plants good infection resulted in the majority of cases.

Further observations on a bacterial root and stalk rot of field corn, H. R. ROSEN (*Phytopathology*, 11 (1921), No. 2, pp. 74-79, figs. 4).—Since the publication of work previously noted (E. S. R., 41, p. 747), the author has carried on work involving both studies and observations on disease symptoms, the extent of injury, corn varieties attacked, and artificial infections.

The bacterial disease of field corn appears as a localized rotting of roots and lower nodes of the stalk, and as spots on sheath, blades, and husks. Seventeen varieties of field corn and one variety of sweet corn are known to be subject to the disease. In one locality the extent of damage in mature corn, resulting in the death of the stalks, varied from 10 to 30 per cent. Fifteen series of isolations revealed a white, rapidly growing bacterium. Artificial infections are reported on more than 100 plants, resulting in nodal rot, root rot, and leaf spot.

On forms of the hop resistant to mildew, V. E. S. SALMON (*Ann. Appl. Biol.*, 8 (1921), No. 3-4, pp. 146-163).—Further observations (E. S. R., 45, p. 543) made during 1920 and reported in this article bring this work (after the seven seasons 1914-1920, inclusive) to a close. The facts observed during 1920 are followed by a general summary of the total results.

The wild hop (*Humulus lupulus*) is composed of a number of forms which show distinctive physiological or constitutional characters, as measured by the grade of susceptibility to the attack of the mildew (*Sphaerotheca humuli*). These characters vary from extreme susceptibility in open or greenhouse conditions to a high degree of resistance in the open and complete immunity in the greenhouse. Of 291 ♀ seedlings 56.70 per cent show extreme susceptibility, while 6.19 per cent are commercially resistant in the open. The remaining seedlings fall into groups representing intermediate grades.

Of 480 seedlings, ♂ and ♀, 5.63 per cent are completely immune, and 1.46 per cent semi-immune under greenhouse conditions. The majority of the seedlings which show complete immunity under greenhouse conditions show a high degree of resistance in the open.

The distinctive degree of susceptibility possessed by a seedling, both as shown in the open and under greenhouse conditions, has shown no change after the plant has been cultivated for five years in a manured hop garden.

Degeneration in Colorado potatoes, E. P. SANDSTEN and C. M. TOMPKINS (*Colorado Sta. Bul.* 278 (1922), pp. 3-15, figs. 8).—A report is given of investigations conducted to determine whether or not degeneration, or the so-called running-out varieties of potatoes in Colorado, is of a permanent nature, whether it is influenced largely by soil and climatic conditions, and whether it will disappear if degenerated tubers are planted in good soil and given the best of attention.

The results of the study indicate that degeneration is caused primarily by a lack of proper seed selection. It is largely influenced by environmental conditions, the different types of soil and climate exerting a great influence on the vegetative parts of the plant during the growing season. Diseases, under field conditions, cause degeneration to a marked degree through a decrease in vigor and yield.

From the results obtained it is concluded that degeneration is not of a permanent nature, but that degenerate tubers, if planted in fertile soils and given proper cultural care, will under favorable climatic conditions produce a crop of potatoes which is better than the seed planted. With degenerate stock, improvement will be in direct ratio to the amount of care given to seed selection by the grower.

Bacillus atrosepticus, the cause of the blackleg disease of Irish potatoes, H. M. JENNISON (*Phytopathology*, 11 (1921), No. 2, p. 104).—The potato blackleg disease (*B. atrosepticus*) was studied by the author as occurring in Montana, beginning in 1913. During the next two years about 40 isolations of the blackleg pathogen were made in studying the relationships of the parasite. Later subcultures of the strains studied by authors named, together with strains of the blackleg organism isolated in Maine, were obtained. In 1915 an exhaustive study of the parasites was begun at the Missouri Botanical Garden, 12 different strains being investigated. As a result of this work it appears safe to conclude that the several strains studied are specifically identical. A revised description of *B. atrosepticus* yields the group number 221.1113033.

Phoma on sweet sorghum, E. KOCH and C. RUMBOLD (*Phytopathology*, 11 (1921), No. 7, pp. 253-268, pls. 3, figs. 3).—Sorghum infected with Phoma was collected in different sorghum-growing States during five successive years, the fungus (a species as yet only partly determined) being found on the leaves of seedlings and the leaves, seed heads, and seed of mature sweet sorghum plants. The fungus remains viable on the seed for a year, but the vitality is low at the end of two years. It has not been found viable on dry infected leaves two years old. Of the 11 varieties of sorghum examined and tested, no variety has been found which is immune to the fungus. The organism can grow on the leaves and stems of the forage sorghum, brown durra, also on sugar cane and corn seedlings, though in these cases it shows slight pathogenicity.

The decay of sweet potatoes (*Ipomoea batatas*) produced by different species of *Rhizopus*, L. L. HARTER, J. L. WEIMER, and J. I. LAURITZEN (*Phytopathology*, 11 (1921), No. 7, pp. 279-284).—The results of the inoculation experiments here described show *Rhizopus nigricans*, *R. tritici*, *R. nodosus*, *R. maydis*, *R. reflexus*, *R. artocarpi*, *R. delemar*, *R. arrhizus*, and *R. oryzae* to be parasitic on sweet potatoes, but *R. chinensis* and *R. microsporus* are not.

The different species can be roughly grouped into high, intermediate, and low temperature forms. These respective forms thrive best at temperatures varying from 30 to 40, 20 to 35, and 15 to 20° C.

Experiments in spraying and dusting tomatoes, F. D. FROMME (*Virginia Sta. Bul.* 230 (1922), pp. 15, figs. 5).—The results are given of spraying experiments conducted for the control of tomato diseases, in which Bordeaux mixture was employed in the seasons of 1918 and 1919, and a dusting experiment conducted in 1922.

In 1918 standard Bordeaux mixture and soap Bordeaux mixture were used for the control of leaf blight and soft rot, and in 1919 additional experiments were carried on with soap Bordeaux mixture for the control of leaf blight. The results of the experiments in 1918 and 1919 indicated that spraying with soap Bordeaux mixture provided a satisfactory control of leaf blight and bacterial soft rot. The increase due to spraying ranged from 34 to 125 bu. per acre.

In 1922 a copper lime dust containing 20 per cent monohydrated copper sulphate was applied with a hand duster, 7 applications being given during the season. Early blight did not become severe at any time during the season.

but late blight (*Phytophthora infestans*) appeared on August 5 and rapidly spread throughout the area. A satisfactory control of late blight was obtained in these tests with copper lime dust, and it is believed that the dusting method offers a practical means for the control of late blight for use in sections where that disease occurs. It is believed that the use of copper lime dust will be of advantage where objections are made against the preparation and application of Bordeaux mixture in small quantities.

Studies on the apple canker fungus.—1, **Leaf scar infection**, S. P. WILTSHIRE (*Ann. Appl. Biol.*, 8 (1921), No. 3-4, pp. 182-192, pl. 1, figs. 2).—An investigation of the biology of apple-tree canker carried on for some years at Long Ashton had for its ultimate object some means of control of this disease, prerequisite to which was knowledge as to how the fungus enters the living tree. Only incidental references are made to the literature of the subject, in view of the summary already published by Cayley (*E. S. R.*, 47, p. 349).

The infection of the apple stem by the canker fungus through the leaf scars is described. The fungus appears to enter through small cracks which appear in the leaf-scar tissues in the autumn immediately after defoliation and in the spring when the buds are swelling. The possibility of preventing this infection by disinfecting the leaf scars with fungicides is discussed, and results of preliminary trials are recorded.

Brown rot of citrus fruit.—Its occurrence in South Australia on oranges, G. SAMUEL (*Jour. Dept. Agr. So. Aust.*, 26 (1922), No. 2, pp. 112-118, figs. 5).—Brown rot (*Pseudomonas citri*) was first noted in South Australia in August, 1922, though present earlier in Victoria. The symptoms locally as described are said to be different from those noted in the United States by Smith (*E. S. R.*, 19, p. 658).

An experiment in the orchard having proved that the fruit is infected from the ground, control methods are indicated.

Notes on the citrus-root nematode, *Tylenchulus semipenetrans*, L. P. BYARS (*Phytopathology*, 11 (1921), No. 2, pp. 90-94, fig. 1).—During 1914 to 1917 the author, while investigating nematodes attacking plants, made observations and studies on *T. semipenetrans*, which parasitizes the roots of citrus species. Observations on its distribution in Florida, studies of the symptoms of the disease, and certain preliminary experimental work on control indicate that the organism may prove to be serious to the citrus industry.

The author has found limited infection at Glen Saint Mary, Gainesville, and Brooksville. At each of these places there has been considerable introduction of citrus stock from other States and even from foreign countries.

In 1917, the author made what is thought to be a significant discovery of the nematode. This was found on the roots of citrus seedlings which had been cultivated in Brazil. Some of these were tangerines (*Citrus nobilis deliciosa*), but the majority were navel oranges (*C. sinensis*), or the species of citrus, White Selecta, from which the Washington navel oranges are said to have originated. It therefore seems quite possible that the nematode may have been introduced into the United States from Brazil.

In 1915 the author placed the roots of badly infected young citrus trees in lots of three in water at different temperatures for various lengths of time. Citrus nematodes were afterwards found on trees treated at 120° F. for 15 minutes, but none could be detected on those treated at any higher temperature. Trees treated at 135 or 140° were dead, and the others usually showed ill effects from the treatments, which were given, however, at the time when the trees were actively growing. The results from this experiment may indicate practical possibilities in hot-water treatment for the elimination of nematodes from nursery stock.

A lotus leaf spot caused by *Alternaria nelumbii* n. sp., E. M. A. ENLWS and F. V. RAND (*Phytopathology*, 11 (1921), No. 2, pp. 135-140, pl. 1, fig. 1).—The leaf disease of the Egyptian lotus (*Nelumbium speciosum*), first noted in 1913 at Kenilworth, D. C., and in the autumn of the year at the New York Botanical Gardens, studied in the summer of 1914 and subsequently, and here described as caused by *A. nelumbii*, appears as very small, smooth, reddish brown flecks which later increase in size until they reach a diameter of 5 to 10 mm. The tendency toward the formation of concentric rings is characteristic. The pathogenicity of *A. nelumbii* to lotus has been demonstrated by repeated isolation and successful reinoculation into healthy plants. No perfect stage was discovered, but the longevity of the fungus under laboratory conditions suggests that under field conditions it may also be capable of living for long periods in the conidial stage.

Field cultures of wood-rotting fungi on agars, B. E. ETTER (*Phytopathology*, 11 (1921), No. 3, pp. 151-154).—This article gives the apparatus needed for field inoculations, the method of packing the culture media for shipment, the media used, methods of inoculation, and the results obtained from the inoculations.

The results obtained from both the eastern and western cultures show contamination from external sources to the number of 13 tubes out of 2,400 and 4 out of 1,800, respectively, showing an average of only 0.4 per cent of contamination. This indicates that cultures of wood-rotting fungi on artificial media can be satisfactorily performed in the field under varied climatic conditions if the precautions outlined in this article are followed.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Animal life in field and garden, J. H. FABRE, trans. by F. C. BICKNELL (*New York: Century Co.*, 1921, pp. VI+391, figs. 92).—This is a translation of the author's work from the French.

The minds and manners of wild animals, W. T. HORNADAY (*New York: Charles Scribner's Sons*, 1922, pp. X+328, pls. 20, figs. 3).—This is a popular work based upon personal observations of the author.

Life zones and mammalian distribution, L. R. DICE (*Jour. Mammalogy*, 4 (1923), No. 1, pp. 39-47).—This is a discussion of the subject as related particularly to Alabama and California.

An act to consolidate and amend the law relating to the protection of animals and birds, and to the introduction, acclimatization, and preservation of animals and birds; and for other purposes (*Brisbane, Queensland: Govt.*, [1922], pp. 14).—The text of the law is given.

Notes on the habits of the chipmunk, *Tamias striatus lysteri*, A. B. KLUGH (*Jour. Mammalogy*, 4 (1923), No. 1, pp. 29-32, pl. 1).—This is a report of observations made at Queen's University, Kingston, Canada.

Observations on wild rats in England, with an account of their ecto- and endoparasites, A. BALFOUR (*Parasitology*, 14 (1922), No. 3-4, pp. 282-298, pls. 2, figs. 3).—Attempts by the author to secure a microorganism which could induce abortion or sterility in wild rats and which could be used in an anti-rat campaign gave negative results. An account, however, is given of certain microorganisms producing pathological conditions in the genito-urinary tract of wild rats. A routine determination of rat parasites including ectoparasites, helminths, intestinal protozoa, and hematozoa was undertaken, and has led to the discovery of a new species of Hymenolepis, has shown that *Heligmosomum braziliense* is present in rats in England, and has also demonstrated the occurrence of hemogregarines in the leucocytes of black rats in this country.

A monograph of the pheasants, III, IV, W. BEEBE (London: H. F. & G. Witherby, 1922, vols. 3, pp. XVI+204, pls. 49; 4, pp. XV+242, pls. 56, fig. 1).—The third volume of this monograph of pheasants, of which the first two have been noted (E. S. R., 45, p. 851), deals with species of the genera *Pucrasia*, *Catreus*, *Phasianus*, and *Syrnieticus*, and the fourth volume with species of the genera *Chrysolophus*, *Chalcurus*, *Polyplectron*, *Rheinardius*, *Argusianus*, and *Pavo*. The fourth volume also includes a discussion of the care of pheasants in captivity (pp. 203-216) and an index to the subject matter. The work, which is about 12×15.75 in., includes full sized colored plates of the forms, while their haunts are shown by photogravures, and there are numerous maps, etc.

Recent progress in our knowledge of parasitic worms and their relation to the public health, W. NICOLL (*Parasitology*, 14 (1922), No. 3-4, pp. 378-401).—This review of the subject includes an eight-page list of references.

Reversal of inhibition by atropin in caterpillars, W. J. CROZIER (*Biol. Bul.*, 43 (1922), No. 4, pp. 239-245).—This is a report of studies of the effect of strychnin and atropin upon caterpillars of several species.

Insect enemies of beets, J. A. BROCK (*Facts About Sugar*, 14 (1922), No. 18, pp. 352, 353; 15 (1922), Nos. 3, p. 58; 6, pp. 118, 119; 10, pp. 198, 199; 11, pp. 220, 223).—A brief account of the more important insect enemies of the sugar beet and means for their control.

Insect pests of the cultivated cotton plant, I, W. W. FROGGATT (*Agg. Gaz. N. S. Wales*, 33 (1922), No. 12, pp. 863-866).—In this first paper on the subject the author deals with the noctuid moths belonging to the genus *Earias*, of which eight species in particular are considered.

[Report on insect and insect control investigations in California] (*California Sta. Rpt.* 1922, pp. 75, 76, 81-88, 134, 135, figs. 2).—In mosquito work W. B. Herms and S. B. Freeborn found that 3 was the largest number of eggs deposited by *Anopheles maculipennis* at a separate laying, the total deposition being 491. An extensive outbreak of bark beetles on large holdings near Pebble Beach was investigated by E. C. Van Dyke, who found the infestation to consist chiefly of the red turpentine beetle, *Ips plastographus* Lec., and *I. radiata* Hopk.

Studies of the relation of leafhopper migrations to the time of sugar beet planting are reported upon briefly. It is concluded that curly leaf in the fog-belt district of the Salinas Valley may be reduced by discontinuing planting from March 1 until May 1 from Gonzales to Monterey Bay. In the fog belt from Chualar to Monterey the soil is usually too wet and the weather too cold and foggy to plant early. Experiments by H. H. Severin, W. J. Hartung, and E. A. Schwing with nicotine dust for combating beet leafhopper have shown that one treatment of kaolin, lime, and Blackleaf 40 10 per cent, applied to an acre of beets, will cause a reduction of 84 per cent of the leafhoppers in an isolated field. The minimum incubation period of the infected principle of curly leaf in the beet leafhopper was found by Severin to be four hours at a maximum temperature of 103° F., a minimum of 94°, and a mean of 100°, and three days in the sugar beet at a maximum temperature of 103°, a minimum of 57.7°, and a mean of 80.3°.

Work by W. P. Duruz with arsenate of zinc and 40 per cent nicotine sulphate has led to the use of these materials against the peach twig-moth, and of arsenate of lead dust, arsenical powders, Nicodust, etc., in many localities. Blackleaf 40 gave 70, 95, and 100 per cent control when applied against the three stages of this pest, respectively, and liquid lime sulphur (Rex) gave good control against all three stages, the best results being obtained by spraying at full bloom, the percentages of control being 80.5, 71.5, and 87.5, respectively.

Work by E. O. Essig on the control of Baker's mealybug (*Pseudococcus maritimus* Ehrh.) has shown a formula consisting of whale-oil soap (or 5 gal. liquid soap or soft soap) 40 lbs., crude carbolic acid (25 per cent) 5 gal., tree distillate (27 to 29° B.) 10 gal., and water to make 50 gal., to be the most satisfactory for a stock solution. Heat should be used in its preparation. For use it should be diluted 1 part to 20 parts of water and applied as a coarse driving spray under 200 to 300 lbs. pressure, great care being taken to drench thoroughly the limbs and trunks.

Spraying experiments by Duruz with the cherry fruit saw-fly (*Hoplocampa cookei* Clk.) show that the pest can be effectively controlled by an application of Blackleaf 40 in combination with miscible oil (Rex 35) or lime sulphur, as the blossoms are opening. Dusting with a new form of tobacco dust (Impco) as the blossoms are opening gave good control, and Nicodust slightly inferior control. In experiments by Duruz and Helbach, spraying with lime sulphur in combination with nicotine sulphate or dusting with Nicodust for the pear thrips failed to give satisfactory results in the orchards examined. Impco seems to have destroyed a high percentage of thrips. The highest control was secured with miscible oil (2-100 gal.) plus nicotine sulphate (0.75 pint-100 gal.) applied with a special nipple jet spray rod, using 300 lbs. pressure.

Tests of the diffusion of hydrocyanic acid gas when heated and not heated are also briefly noted.

Experiments with poisoned baits for grasshoppers, M. H. SWENK and E. E. WEHR (*Nebraska Sta. Bul.* 183 (1923), pp. 28, fig. 1).—Experiments conducted during the summer of 1922, in which 22 different baits were tested, almost entirely with the two-striped grasshopper (*Melanoplus bivittatus*), are reported upon.

The results obtained have led to the conclusion that beet pulp used as a base, while 50 per cent cheaper than wheat bran, is only about 66 per cent as attractive, and that fresh horse manure has about the same degree of attractiveness as beet pulp. This has led to the recommendation that wheat bran be used as the base, since fresh leaves, although 22 per cent more attractive, are not suited for use as a base. Baits containing white arsenic are 8 to 10 per cent more attractive than baits containing Paris green, and are from 25 to 35 per cent more attractive than baits containing crude arsenic. Calcium arsenate is 18 per cent more attractive than Paris green. Paris green is too expensive for use on a large scale, since it costs over three times as much as white arsenic and is only 5 or 6 per cent more effective, and calcium arsenate, which is about equal to white arsenic in efficiency, has its somewhat greater attractiveness offset by its one-third greater cost as compared with white arsenic.

"Crude arsenic is slightly more efficient than Paris green and distinctly more efficient than white arsenic or calcium arsenate, and is even slightly cheaper than white arsenic, but it has a deterrent effect when used in a grasshopper bait that makes its use less preferable, on the whole, than the use of white arsenic. Crude arsenic kills the poisoned grasshopper very quickly, Paris green much less quickly, white arsenic a little more slowly than Paris green, and sodium arsenite and calcium arsenate considerably more slowly than white arsenic. A fine light grade of white arsenic is, on the whole, to be recommended for use as the poison in grasshopper baits when a dry poison is used. Arsenite of soda, made by boiling white arsenic and sal soda, forms a very efficient poison in grasshopper baits, more efficient in our test than any of the dry poisons, and is to be recommended for use.

"Bran mash without a special attractant added is attractive, but a good special attractant increases the attractiveness of the bait. Molasses not only

sults indicate that the most satisfactory results are obtained from spraying with a reliable miscible oil just before the eggs commence to hatch.

"In cases of severe infestations this spray should be supplemented by an arsenical spray applied as soon as the eggs have hatched. The use of lead arsenate in excess of 2 lbs. to 50 gal. or the addition of sirup does not materially add to the efficiency of the spray. Miscible oil sprays when properly emulsified are considered safe to apple trees unless the spraying is preceded or followed by excessively cold weather arbitrarily suggesting 20° F. below zero as minimum temperature. Nicotin dust and liquid sprays of nicotin sulphate or Derrisine have given no practical control."

In 1922, 91.8 and 92.8 per cent of the eggs were destroyed by Dormoil and Dormant Soluble Oil, respectively, each at a 10 per cent strength.

Notes on the life histories of two Mesopotamian moths, Y. RAMACHANDRA RAO (*Bul. Ent. Research*, 12 (1922), No. 4, pp. 477-479).—These notes relate to *Ocnogryia amanda* Staud., which is a pest of figs, and *Theretra alecto* L., which attacks the foliage of the grape.

The European corn borer and its control, D. J. CAFFREY and L. H. WORTHLEY (*U. S. Dept. Agr., Farmers' Bul.* 1294 (1922), pp. II+45, figs. 24).—This publication has been prepared with a view to supplying practical information on the European corn borer to corn growers, corn canners, dealers in green vegetables, and market and home gardeners.

Insects in dried fruits: Experiments in sterilization for their control, K. C. MCKEOWN (*Agr. Gaz. N. S. Wales*, 33 (1922), No. 9, pp. 642-646; also in *Fruit World Australasia*, 23 (1922), No. 11, pp. 386-388, figs. 2).—This is a discussion of the dehydrating plant and of the effect of high temperature on infestation by the Indian-meal moth in its several stages of development. In early experiments the fruit was treated at a temperature as high as 200° F., but it was found that this temperature could be reduced by more than 25 per cent without loss of efficiency, the most efficient temperature proving to be 145 to 146° for 10 to 15 minutes.

The control of the grub of the potato moth, J. T. RAMSAY (*Jour. Dept. Agr. Victoria*, 20 (1922), No. 10, pp. 590-594, figs. 3).—Control measures for *Lita solanella* Boisd. are discussed. The author has found that a considerable measure of relief is obtained by immersion of the tubers in the emulsified oil compound known as Tuberol at a strength of 1: 30. Sprouting is not affected by the solution, and immersion for five minutes is sufficient to render tubers immune from damage. It is estimated that 1 gal. of the compound is sufficient to treat 2 tons of potatoes.

[**An undetermined dipteran injurious to alfalfa in France**], DENAIFEE and COLLE (*Jour. Agr. Prat., n. ser.*, 35 (1921), No. 41, p. 313, figs. 2).—This is a brief account of a deformity in the alfalfa plant due to a hypertrophy in the lower part of the leaves of the corolla which causes the tips to curve slightly inward, giving the flower a globular appearance, its petals being so arranged as to form a cone. This is caused by the presence of larvae of an undetermined dipteran, of which as many as 12 to 20 may be present in a single flower.

The Coleoptera of Europe: France and the neighboring region, C. HOULBERT (*Les Coléoptères d'Europe: France et Régions Voisines. Paris: Libr. Octave Doin*, 1921, vol. 1, pp. [V]+332, figs. 313; 1922, vol. 2, pp. [I]+840, figs. 539).—In the first part of the first volume of this handbook (pp. 21-141), the author deals with the general morphology, nutrition, adaptations, and reproduction; in the second part (pp. 143-206) with embryogeny, general biology of the larvae, and classification of the adults; while the third part (pp. 207-304)

consists of an illustrated account of the genera of the Coleoptera of Europe, which is continued through the second volume. The first volume includes a brief glossary (pp. 1-10) and a list of the principal coleopterists (pp. 11-13), and the second volume a bibliographical index of the anatomy and biology of Coleoptera (pp. 301-304) and of general and local faunas (pp. 304-313).

The apple root-borer (*Leptops hopei*), C. FRENCH and L. PILLOUD (*Jour. Dept. Agr. Victoria*, 19 (1921), No. 10, pp. 605-607, figs. 4).—The author reports preliminary experiments with explosives for the control of this borer, which is probably the worst pest with which orchardists in Victoria have to contend. In this work gelignite was placed in holes, each 3 ft. deep and 3 ft. from the tree, there being from one to four holes to a tree. The new growth of the trees and the new roots of the affected trees have led to the conclusion that this treatment will prove successful, but experiments must be continued for another year or two before its general use can be recommended.

Beetles damaging seasoned timber, A. M. ALTON (*Timber Trades Jour.*, 91 (1922), Nos. 2381, pp. 925, 926, figs. 2; 2382, pp. 979-981, fig. 1; 2383, pp. 1042, 1043, figs. 2; 2384, p. 1106; 2385, pp. 1170, 1171, figs. 2; also London: William Rider & Son, Ltd. 1922, pp. 24, figs. 7).—This deals with the life history and habits of Lyctidae and Anobiidae, with a note on their injury and remedial measures.

The lead-cable borer or "short-circuit beetle" [*Scobicia declivis* Lec.] in California, H. E. BURKE, R. D. HARTMAN, and T. E. SNYDER (*U. S. Dept. Agr. Bul.* 1107 (1922), pp. 56, pls. 10, figs. 15).—The authors first give a review of the injury to metals by boring insects throughout the world, including injury to lead fuses, and then discuss the damage to lead sheathing of aerial cables by *S. declivis*, a powder-post beetle of the family Bostrichidae, investigations of which insect, are considered at length. A report of the author's study of the biology of this species (pp. 11-20) is followed by a discussion of control experiments (pp. 20-40), much of the data relating to which are presented in tabular form.

It appears that one of the most important injuries of insects to manufactured articles of metal is that to the lead sheathing of telephone cables in California by *S. declivis*. This injury consists of circular holes about 0.1 in. in diameter that penetrate the sheathing and allow the entrance of moisture, resulting in a short-circuiting of the wires and the resulting stoppage of service to the public. *S. declivis* normally lives in the wood of the live oak and other trees, requiring about one year to complete its development from egg to adult. During the summer season some beetles periodically attack the cables and cause damage. Practically all of the boring is done near the point of contact of the cable and the rings which suspend the cable from the messenger strand that supports it, due to the fact that the beetle must have a foothold from which to attack the cable. The experiments conducted indicate that the beetle is able to penetrate any lead alloy used as a cable sheathing or any poison or repellent placed on the sheathing. Beef tallow appears to be the best grease to place upon the rings to adhere to the beetle when it is most active and suffocate it.

"Layers of friction tape impede the boring and thin sheets of copper, zinc, and steel prevent it. Sleeves of these metals can be placed around the cable at the rings, but the cost probably would be too great for general use. At the present time tallowing the rings is the most promising method of control. During the season of 1921 it was found that the beetles were unable to penetrate pure gum rubber. No definite results were obtained from experiments

with the various types of suspension rings. The beetles in the cages would not enter at any of them. It is believed that the new type of ring, made of flattened steel-wire stock, galvanized, which the telephone companies are now installing, is better from the standpoint of preventing attack by the beetle than the older one."

An annotated list is given of 68 references to the literature, of which the first 55 relate to insects attacking or penetrating metals and the remaining 13 to *S. declivis*, its biology and taxonomy. The Taxonomy and Morphology of the Larval Stages of *S. declivis* is dealt with by A. G. Böving, in an appendix (pp. 49-54); and a Description of the Mature Adult of *S. declivis* is given by R. D. Hartman (pp. 54-56).

Boll weevil control with sirup (or molasses) and calcium arsenate, compiled by W. J. MIMS (*Ensley, Ala.: [Compiler], [1921], pp. 15*)—A compilation of recent investigations on the subject.

Bees for the horticulturist, J. H. MERRILL (*Topeka: Kans. State Hort. Soc., 1922, pp. 23*)—A practical account intended particularly for the horticulturists.

On the life history of Melittobia acasta Wlk., a chalcid parasite of bees and wasps, F. B. BROWN (*Parasitology, 14 (1922), No. 3-4, pp. 349-370, pl. 1*).—This is an account of a chalcid that is ectoparasitic upon a number of species of Hymenoptera and upon the pupae of certain flies. The data presented are based upon rearings made in the laboratory. The paper includes a bibliography of 17 titles.

California gall-making Cynipidae, with descriptions of new species, I. McCracken and D. Egbert (*Stanford Univ. Publ., Univ. Ser., Biol. Sci., 3 (1922), No. 1, pp. 70, pls. 2*).—This deals with 110 species of California cynipid gall insects, of which 21 are described as new.

The conifer spinning mite on Sitka spruce (Oligonychus (Paratetranychus) ununguis Jac.), N. Cunliffe and G. B. Ryle (*Quart. Jour. Forestry, 17 (1923), No. 1, pp. 359-362, figs. 2*).—A brief account of this mite, which has recently been found in large numbers attacking young Sitka spruce trees in Bagley Wood, near Oxford.

FOODS—HUMAN NUTRITION.

Further contributions to the knowledge of organic foodstuffs with specific action, XIII-XVIII, E. Abderhalden et al. (*Pflüger's Arch. Physiol., 194 (1922), No. 6, pp. 647-673, figs. 5; 195 (1922), Nos. 1-2, pp. 1-21, figs. 19; 3, pp. 199-226, figs. 4; 4-5, pp. 432-486, figs. 27*).—These six papers continue the series previously noted (E. S. R., 47, p. 859).

XIII. The deficient oxygen supply of the cells as cause of the phenomena of alimentary dystrophy in pigeons, E. Abderhalden and E. Werthelmer (pp. 647-673).—In this paper the question of the impaired gaseous metabolism of the cells in polyneuritis is again considered, and experiments are reported which indicate a heightened susceptibility to oxygen deficiency in pigeons fed on polished rice. Two pigeons, one normally fed and one fed polished rice, were placed in a large bell jar from which the air was gradually withdrawn. In three such experiments the bird on the polished rice diet showed the effects of the insufficient air supply much sooner than the normal bird, and also recovered more promptly when air was again admitted to the jar. In a similar experiment in which a fasting and a normal bird were used no such difference could be detected.

This paper also contains a lengthy discussion of the paper by Hess in which it is reported that symptoms identical with polyneuritis can be induced

in pigeons by the injection of potassium cyanid (E. S. R., 47, p. 168). A repetition and extension of this work is reported with the following results:

Active yeast preparations had no effect on the symptoms induced by cyanid injections. A heightened instead of a lowered metabolism followed the injection of cyanid. The gaseous metabolism of cyanid-poisoned pigeons was not lowered appreciably, nor was it altered on the administration of yeast. Pigeons maintained on polished rice showed no greater sensitiveness toward potassium cyanid than normally-fed pigeons. It is concluded that there is no resemblance between the phenomena of cyanid poisoning and those following polished rice feeding.

XIV. E. Abderhalden and E. Gellhorn (pp. 1-21).—This paper reports the results of a study of the effect upon the smooth, striped, and heart muscle of frogs of various extracts of yeast, including water and alcohol extracts of fresh yeast, the alcohol extract of hydrolyzed yeast, and the dialysis fractions of autolyzed yeast. The significant feature of the findings reported is that while some of the extracts showed only a paralyzing negative inotropic action and others in similar concentration were able to stimulate the various muscles tested, the extracts which had the stimulating effect were in all cases protein-free. Certain of the extracts, also protein-free, had the power of dilating the pupils of the enucleated eyes of frogs, either directly or indirectly through increasing the effect of adrenalin.

XV. *Feeding experiments with artificially prepared organic foodstuffs and with individual constituents of these foodstuffs with and without the addition of nutramins*, E. Abderhalden (pp. 199-226).—In this investigation the question of the nutritive value of different amino acids and the possibility of substituting the hydrolysis products of proteins for the proteins themselves, which was the subject of an earlier investigation (E. S. R., 35, p. 63), is considered in the light of the newer knowledge of nutrition. On account of the cost of materials, mice and rats were used instead of dogs as experimental animals, and the changes in weight were followed in general in place of determinations of the nitrogen balance. Preliminary experiments showed that for a short time mice and rats could be kept in weight and nitrogen equilibrium on a mixture of various amino acids, glycerin, fatty acids, salts, and water, but that the lack of nutramins [vitamins] soon made itself apparent. The addition of small amounts of yeast, together with butter, liver oil, etc., remedied this deficit and made the diet suitable for use in determining the biological value of the different amino acids.

The results obtained by omitting one after another of the purified amino acids in general confirmed the earlier conclusions. Tryptophan and cystin proved indispensable. Tyrosin and phenylalanin could be used interchangeably, but one or the other was necessary. Lysin, arginin, and histidin were not replaceable. Nor-leucin and isoleucin could be replaced by true leucin (α -aminoisobutylic acid). The entire absence of 6-carbon monamino acids resulted in a loss of body weight. Aspartic and glutaminic acid were indispensable, but glycine, alanin, and oxyglutaminic acid appeared to be replaceable. Lack of purins and pyrimidin bases and of cholesterol was apparently without effect, at least for the length of time covered by the experiments.

XVI. *Comparative studies of the action of heated and nonheated bran and yeast and of organs of normally nourished pigeons and those fed on polished rice*, E. Abderhalden (pp. 432-459).—This paper consists principally of a lengthy discussion in which an attempt is made to explain the phenomenon of the deficiency in oxygen supply in avian polyneuritis. The effect of vitamin B on cellular metabolism is considered so marked that the name "oxygene" is

suggested as most appropriate for this vitamin. While arriving at no satisfactory explanation of the mechanism of its action, the impression is given that its function is that of a stimulant to the metabolic processes.

XVII. E. Abderhalden and E. Wertheimer (pp. 460-479).—In an effort to explain the increased sensitiveness to a lack of oxygen of pigeons fed polished rice, as noted in Paper XIII, a series of experiments was undertaken, the scope and results of which may be summarized as follows:

On exposing a normal and a polished rice-fed pigeon to air excessively rich in carbon dioxid, results similar to those reported in Paper XIII were obtained, the normal pigeon being able to withstand the harmful effect of excessive carbon dioxid much longer than the pigeon fed polished rice. Pigeons thus treated were then placed in a respiration chamber and the carbon dioxid output determined. No difference could be noted between the normal and the rice-fed subjects. Respiration in polyneuritic pigeons was much slower than in normal, particularly after paralysis had set in. In preliminary experiments with human subjects, it was found that exposure to the rays of a quartz mercury vapor lamp caused a temporary increase in the respiration of the red blood cells. Similarly, exposure of polyneuritic pigeons to ultraviolet light caused a temporary increase in metabolism and rise in temperature. Polyneuritic pigeons showed a heightened sensitiveness to parenteral injections of adrenalin.

Polyneuritic pigeons proved as capable as normal pigeons of synthesizing ornithuric acid following the feeding of benzoic acid. The pulse rate of pigeons fed for some time on polished rice was much slower than that of normal pigeons.

XVIII. *Experiments with purified foodstuffs*, E. Abderhalden (pp. 480-486).—Typical symptoms of polyneuritis were induced in pigeons by the following diet: 5 gm. of carefully purified casein, 10 gm. of pure maltose, 5 cc. of olive oil or 1 gm. of stearic and palmitic acid and 1 cc. of oleic acid, 1 cc. of glycerin, and 5 gm. of a salt mixture containing 1 part of magnesium sulphate and iron nitrate, 1.5 parts of sodium chlorid and sodium phosphate, 2 parts of calcium phosphate, 4 parts of potassium phosphate and calcium carbonate, and 0.1 part of sodium fluorid and sodium iodid.

Studies on vitamins B and D, C. FUNK and J. B. PATON (*Jour. Metabolic Research*, 1 (1922), No. 6, pp. 737-775, *figs.* 16).—This paper consists of brief reports of experiments on the rôle played by vitamin B in metabolism and a comparison of the properties of vitamins B and D.

The method adopted as most satisfactory for the vitamin B tests consisted in feeding individual pigeons on polished rice and sufficient vitamin in the form of a yeast preparation to keep them in weight equilibrium. The pigeons were kept in individual cages and the food intake and weight recorded daily. After the minimum dose of vitamin to maintain constant weight had been determined, it was found that the pigeons responded rapidly to an increase in vitamin and that a period of 4 or 5 days was sufficient to test the activity of any vitamin preparation. It is noted that pigeons have been kept in good condition for over 6 months on polished rice supplemented by a highly purified extract of vitamin B. Rats are considered by the authors to be less desirable than pigeons for testing for vitamin B, although it is stated that in similar tests a period of from 10 to 14 days sufficed to determine vitamin activity.

To study the influence of carbohydrates on the requirements of pigeons for vitamin B, 8 pigeons receiving the minimum dosage of vitamin B for maintenance were forcibly fed with a starch suspension, with the result that the birds stopped eating rice but maintained their weight for a considerable time

on the starch alone. When the amount of starch was somewhat reduced and a small amount of casein and salt mixture was added, the rice intake increased. On omitting the rice and feeding only casein, starch, and sugar, the pigeons increased in weight on the minimum vitamin allowance. Another series of pigeons in vitamin equilibrium was given raw egg albumin in addition to the rice. This was considered to have a decided vitamin-sparing influence, as the daily vitamin dose could be quite materially reduced and the birds kept at constant weight. When egg white was fed alone the characteristic initial loss of weight usually observed on a vitamin-free diet of polished rice was delayed, but the birds finally developed the disease. The authors conclude from the starch and protein experiments that protein exerts a sparing action on vitamins.

To determine whether a low vitamin intake by increasing metabolism produces beriberi earlier than when the diet contains no vitamin, 6 pigeons were fed polished rice with about one-fourth the minimum dose of vitamin and 6 others were given no vitamin. The latter developed polyneuritis, while those receiving subminimal doses of vitamin were still in good condition.

The minimum vitamin requirements of 14 different pigeons were found to vary from 0.09 to 2 cc. of the same yeast preparation. When the pigeons received just enough vitamin to be in weight equilibrium, the daily food requirement of polished rice was about one-twenty-eighth of the body weight.

When double the daily dose of vitamin was given on Saturday and none on Sunday, as is the custom in many laboratories, it was found in general that the pigeons lost in weight on the second day. This is attributed largely to the fact that after the double dose the food intake was larger for the first day than the second. That vitamin B is stored to some extent in the body is thought to be indicated by the fact that pigeons on minimum vitamin dosage respond more quickly to the removal of the vitamin from the diet than pigeons which have been on a normal diet.

In the comparison of vitamins B and D, as determined by pigeon and yeast growth experiments, it was found that yeast growing on a medium containing both vitamins removes from the medium D but not vitamin B, that mold growth from contamination of the medium by exposure to air also removes vitamin D but not vitamin B, and that vitamin B is more readily destroyed than vitamin D by alkalis and by autoclaving at high temperature and pressure.

Nutritional factors in the growth of yeasts and bacteria, I, II, L. FREEDMAN and C. FUNK (*Jour. Metabolic Research*, 1 (1922), No. 4, pp. 457-480).—Two papers are presented.

I. Vitamins (pp. 457-468).—In this paper the authors report a study of the growth-promoting property of yeast and beef-heart infusion for hemolytic streptococci and yeast cells, particularly with a view to determining whether the activity of both materials is due to the same or different growth-promoting substances or vitamins.

Uncolorized beef-heart infusion was found to contain a growth-accelerating substance for streptococci, while the same infusion decolorized by boiling with Norit failed to promote growth. The addition of a glucose salt solution to the decolorized medium failed to improve it, but the addition of 1 per cent peptone or 5 per cent autolyzed yeast, adjusted to a pH of 7.4 to 7.8, restored the growth-promoting properties of the medium. The same media tested for the growth of yeast cells by the method of Funk and Dubin (*E. S. R.*, 44, p. 861) gave similar results.

Autolyzed yeast, when subjected to fractional adsorption with fuller's earth by the method of Funk and Dubin (*E. S. R.*, 46, p. 759) and to a similar

fractional adsorption with Norit, gave, on the first shaking with 50 gm. of fuller's earth per liter, a filtrate which showed little loss of growth-stimulating effect on yeast cells and no apparent loss of stimulation to bacterial growth. This filtrate, on shaking with 100 gm. of fuller's earth per liter, gave a second filtrate which was only about one-half as effective as the first for yeast growth and gave as a rule no growth of streptococci. On a third shaking with fuller's earth (100 gm. per liter) the resulting filtrate was entirely lacking in growth-promoting properties. The three samples of fuller's earth were then extracted with barium hydroxid according to the method of Seldell (E. S. R., 45, p. 612) and the resulting extracts tested for growth-promoting effect on yeast and streptococci, and the second extract for curative effect on polyneuritic pigeons.

The first extract gave strong growth-stimulating action for yeast cells and streptococci, the second almost as good growth of the yeast and slightly diminished growth of streptococci, and the third showed no growth-promoting effect. The second extract had no curative effect on polyneuritic pigeons, showing that practically all of the antineuritic vitamin had been adsorbed by the first shaking.

The several samples of Norit were extracted with acetic acid according to the method of Eddy et al. (E. S. R., 46, p. 164) and the resulting extracts tested for activity with results similar to those obtained with fuller's earth. These results are thought to furnish sufficient evidence that the growth-promoting vitamin for yeast, provisionally called vitamin D, can be obtained almost free from vitamin B by fractional adsorption with fuller's earth and Norit. It is noted, however, that thus far it has been found impossible to obtain vitamin B, the antineuritic vitamin, completely free from vitamin D.

Similar attempts at fractionating the growth-promoting substances from beef-heart infusion are reported with somewhat similar but not identical results. The first extract, obtained by shaking the infusion with 50 gm. of fuller's earth per liter, had very little stimulating effect on yeast growth but promoted the growth of streptococci. The second filtrate was inactive for both yeast and streptococci. The first shaking with Norit removed practically all of the yeast growth-stimulating substance and the second all of the growth-promoting substances. The barium hydroxid extract of the first and second fuller's earth fractions showed only a slight growth-stimulating activity on yeast and a slight activity for streptococci. On the other hand, the acetic acid extract of the first Norit fraction gave good stimulation to both yeast and streptococci and the second extract no stimulation. It is concluded that the growth-promoting substances are present in smaller amounts in beef-heart infusions than in autolyzed yeast, and that they are more easily adsorbed from the former than from the latter.

II. *Protein hydrolysates* (pp. 469-480).—This paper reports the results of an investigation of the effect of various protein hydrolysates on the growth of streptococci and yeast. The various proteins were prepared according to standard methods and were hydrolyzed by boiling with 7 parts of concentrated hydrochloric acid (specific gravity 1.19) for from 8 to 10 hours. After cooling and filtering off the humin, the filtrate was evaporated to dryness, taken up with water, and evaporated again, the process being repeated several times to remove the bulk of hydrochloric acid. The remaining acid was then neutralized with N NaOH and the solution made up to a volume corresponding to a 10 per cent solution of the original protein, adjusted to pH 7.3, and sterilized at 10 lbs. pressure for 10 minutes. The solutions were then tested for their effect on the growth of streptococci as in the previous study, and in addition a rough

quantitative test of the bacterial growth was made by determining colorimetrically the change in H-ion concentration of the media after definite periods of time.

Positive results were obtained with the hydrolysates of commercial and purified casein, lactalbumin, egg globulin, commercial gelatin, edestin, hordein, and yeast protein. In a similar study of the effect of the protein hydrolysates on yeast growth, negative results were obtained with everything except the hydrolysates of casein and yeast protein.

A comparison of these results with the methods of purification and the physical structure of the various proteins has led to the conclusion that the activity is not due to a constituent part of the protein molecule, but depends on the physical and adsorptive properties of the protein and the method and degree of purification. If the protein has been obtained from a medium rich in water-soluble vitamin of the B type and if its physical structure is such as to cause it to adsorb vitamin readily, the hydrolysate will still contain sufficient vitamin to promote growth.

To test the theory that the active substances present in casein are nothing but adsorbed vitamins, a solution of neutral sodium caseinate was prepared from the purified casein which had given positive results. This neutral sodium caseinate solution was shaken for three hours with 50 gm. per liter of fuller's earth, the fuller's earth extracted with barium hydroxid, and the extract tested for its growth-promoting properties. It was found to have a strong stimulating effect on the growth of streptococci, but no action on the growth of yeast cells. The filtrate from the shaking with fuller's earth was subjected to hydrolysis and the hydrolysate tested for growth-promoting activity, with negative results for both streptococci and yeast.

"It is, therefore, apparent that most or all of the vitamin was removed from the casein as described. This shows that the active substance in the protein is not necessarily a constituent part of the protein molecule, and does not have to be isolated by breaking up the protein."

The transformation of protein into fat and fat into carbohydrate in the body, H V ATKINSON (*Jour. Metabolic Research*, 1 (1922), No. 5, pp. 565-607, fig. 1).—This paper consists of an extensive review of the literature on the subject of possible transformations in the body of fats, carbohydrates, and proteins, and the detailed report of an investigation of the possibility of the transformation of food proteins into tissue fats and food fats into tissue carbohydrates. The experimental approach to the first question was along two lines: First, the respiratory exchange and heat production of dogs stuffed with large quantities of lean beef-heart were measured in a series of experiments which have been reported from another source (E. S. R., 48, p. 161). Second, an extensive study was made of the chemical changes taking place in the blood of dogs under similar conditions of meat stuffing. For this purpose healthy and well-nourished dogs were fed a liberal mixed diet late in the afternoon and a sample of blood was drawn from the left heart through a hypodermic needle on the next morning. Immediately after drawing the first sample of blood, the dogs were fed as much lean beef-heart as they would eat. A second sample of blood was drawn 5 or 6 hours later and in some cases a third sample 24 hours later. Four dogs were used and the experiments repeated four or five times.

A comparison of the changes in the blood under the influence of the ingestion of large amounts of meat with the changes following a mixed diet showed that in both there was a slight increase in alkaline reserve. The increase in blood sugar after meat stuffing was from two to six times greater than after feeding a mixed diet, thus indicating a production of blood sugar from protein.

This increase in blood sugar was much greater after the high meat feeding for the first few days than later. This and the fact that while there was no increase in blood fat following the feeding of a mixed diet there was a considerable increase on the days of high meat feeding are thought to indicate the formation of fat from protein. The respiration tests previously reported and the blood tests are thought to furnish evidence that when the glycogen reservoirs of the body are low the ingestion of meat in large quantity results in the deposition of glycogen, but that when the glycogen reservoirs become filled as a result of feeding meat in great excess, fat alone is retained. In discussing the intermediary steps in this transformation it is considered unnecessary to assume that glucose is an intermediary product, but rather that the usual intermediary reaction in the formation of carbohydrates from amino acids proceeds to the point which is common to both carbohydrate formation from amino acids and fat formation from carbohydrate, i. e., lactic acid, methyl glyoxal, and glyceric aldehyde, and that through these products the transformation of protein to fat proceeds.

The question of the transformation of food fats into tissue carbohydrates was studied by observing the changes taking place in the blood of dogs under the influence of morphine (which is known to depress oxidative processes), during the ingestion of large quantities of fat alone, and during the ingestion of large quantities of fat while under the influence of morphine. A normal sample of blood was drawn and then 1 gm. of morphine sulphate was injected subcutaneously in divided doses. Olive oil was used as the fat and was given through a stomach tube. From time to time samples of the blood were drawn for analysis.

Under the influence of morphine alone the CO_2 -combining power of the blood increased 16 per cent, but under the combined influence of morphine and fat it dropped 3 per cent below normal. The ingestion of large quantities of fat alone also caused a drop in the CO_2 -combining capacity of the blood plasma. The blood sugar increased 72 per cent under the influence of morphine alone, 39 per cent under the influence of morphine and fat, and about 14 per cent through fat alone. The total blood fat increased 10 per cent in the first period, 64 in the second, and 53 per cent in the third. These results are thought to support the opinion, but not to furnish definite proof, that fat can be transformed into sugar in the body. A bibliography of 92 titles is appended.

A comparison of the nitrogenous metabolism during single and fractional feedings, A. CHANUTIN and L. B. MENDEL (*Jour. Metabolic Research*, 1 (1922), No. 4, pp. 481-488).—To determine whether there is a difference in the utilization of a definite amount of protein, depending upon the rate at which it is furnished to the organism, three dogs were kept in metabolism cages on a diet of commercial caseln, lard, butter fat, dried yeast, sugar, bone ash, and salt mixture. In each series of experiments the total daily diet was unvaried, but during the first and third periods the food was offered in a single meal and in the second period was divided into equal small portions which were fed at intervals of 1½ hours over a period of 12 hours. Daily determinations were made of the total nitrogen content of the urine and feces. Each series of experiments was continued for from 19 to 24 days. In three experiments the animals were on a low protein and in two on a high protein diet, the nitrogen intake in grams per kilogram of body weight varying from 1.6 to 9.36.

In no case could any significant variation in nitrogen utilization be noted as the result of fractional feeding. Using as illustration the series of lowest and highest nitrogen intake, the nitrogen balances for the three periods were -0.15 , -0.39 , and -0.42 and $+0.16$, $+0.32$, and -0.07 , respectively.

Studies on experimental rickets.—XX, The effects of strontium administration on the histological structure of the growing bones, P. G. SHIPLEY, E. A. PARK, E. V. MCCOLLUM, N. SIMMONDS, and E. M. KINNEY (*Bul. Johns Hopkins Hosp.*, 33 (1922), No. 376, pp. 216–220, pl. 1, figs. 2).—In this continuation of the series of papers on experimental rickets (E. S. R., 47, p. 567), the effect on the growth and bone development of rats of the replacement of calcium by strontium in an otherwise adequate diet has been studied by the usual methods. In connection with this report a summary is given of an earlier investigation of the effect of strontium on bone development in dogs by F. Lehnerdt.¹

The basal diet used consisted of liver (cooked and dried) 20, casein 10, potassium chlorid 1, sodium chlorid 1, dextrin 65, and butter fat 3 per cent. This diet contained, in 100 gm., 0.0008 gm. of calcium and 0.406 gm. of phosphorus, and was considered to be deficient only in its lack of calcium. On the addition of calcium to the extent of 1.5 per cent of the food mixture rats were able to develop in a normal manner, but without this addition no growth was possible and a condition resembling rickets was produced. With the calcium replaced by its atomic equivalent of strontium, typical rickets developed even in the presence of cod liver oil.

Studies on experimental rickets.—XXI, An experimental demonstration of the existence of a vitamin which promotes calcium deposition, E. V. MCCOLLUM, N. SIMMONDS, J. E. BECKER, and P. G. SHIPLEY (*Jour. Biol. Chem.*, 53 (1922), No. 2, pp. 293–312, figs. 5).—Evidence along three different lines is presented which is considered by the authors to demonstrate clearly “the existence of a fourth vitamin whose specific property, so far as we can tell at present, is to regulate the metabolism of the bones.”

The first line of evidence consisted of a comparison of several oils for potency in curing xerophthalmia in rats. Secondly, the same fats were compared as to their value in promoting growth in young rats on a diet low in calcium, and, finally, a similar comparison was made of the value of these fats in inducing the deposition of the line of calcium salts in rachitic bones as determined by the line test previously described (E. S. R., 47, p. 566).

In the first test it is stated that 2 per cent of cod-liver oil, 3 of shark-liver oil, 3 of burbot-liver oil, and 2 of butter fat brought about a prompt cure of incipient xerophthalmia, while vegetable fats in amounts constituting from 8 to 20 per cent of the diet failed to cure it. It is especially emphasized that 15 per cent of coconut oil did not cure or prevent xerophthalmia. Cod-liver oil oxidized with a stream of air bubbles at the temperature of boiling water for from 12 to 20 hours failed when fed to the extent of 2 per cent of the diet, but similar amounts of cod-liver oil oxidized for 4 hours effected a cure.

For the second test a diet was used which was somewhat deficient in vitamin A, low in calcium, and not far from the optimum in phosphorus. This was fed with the fats to be tested in the following proportions: Cod-liver oil, 1 per cent; butter fat, 10; shark-liver oil, 3; coconut oil, 10; cottonseed oil, 10; and olive oil, 10 per cent, respectively. Of these fats, cod-liver oil, shark-liver oil, butter fat, and coconut oil appeared to increase the efficiency of the animal in utilizing the low calcium supply, while cottonseed oil and olive oil did not.

In the third test the so-called line test was used as a delicate means of comparing the various fats and oils as to their ability to initiate healing of rickets, maize oil and sesame oil being included among the vegetable oils examined. From the tabulated results, it would appear that cod-liver oil, shark-liver oil, and burbot-liver oil are highly effective in moderate doses in causing deposition

¹ Beitr. Path. Anat. u. Allg. Path., 47 (1909), No. 2, pp. 215–247.

of calcium, and that butter fat is also effective but that it has to be fed in large amounts (from 15 to 30 per cent) and over a longer period (14 days). Compared with this, coconut oil when fed as 20 per cent of the diet caused in 15 days the deposition of small amounts of calcium salts in the bones. Maize oil, olive oil, cottonseed oil, and sesame oil, when similarly fed, were ineffective. Samples of cod-liver oil which had been oxidized for 4, 12, and 20 hours, respectively, were still effective in promoting deposition of calcium, although those oxidized for 12 and 20 hours had entirely lost their property of curing xerophthalmia.

Studies on experimental rickets.—XXII, Conditions which must be fulfilled in preparing animals for testing the antirachitic effect of individual foodstuffs, E. V. McCOLLUM, N. SIMMONDS, P. G. SHIPLEY, and E. A. PARK (*Bul. Johns Hopkins Hosp.*, 33 (1922), No. 378, pp. 296–302).—The dietary conditions which must be fulfilled in conducting the line test (*E. S. R.*, 47, p. 566) are discussed in considerable detail, with experimental data illustrating the anatomical changes which are brought about by relatively small variations in the composition of the diet. It is noted that calcium lactate proved a less satisfactory source of calcium for promoting bone growth than did calcium carbonate.

Factors which determine the concentration of calcium and of inorganic phosphorus in the blood serum of rats, B. KRAMER and J. HOWLAND (*Bul. Johns Hopkins Hosp.*, 33 (1922), No. 379, pp. 313–317).—With a view to ascertaining the factors that control the concentration of calcium and inorganic phosphorus in the blood serum, determinations were made of the calcium and inorganic phosphorus content of the blood serum of many of the rats whose bones and tissues have been examined in the course of the extensive investigation of rickets in rats noted above.

It has been found impossible to increase the concentration of either element beyond normal limits by various additions to the diet, or by physical means such as exposure to ultraviolet light. On the other hand, it is possible to reduce the concentration of either of these elements by feeding diets containing insufficient quantities of the respective elements. A deficiency which is not sufficient to be detected in the first generation will be accentuated in the succeeding generations.

When the diet contains sufficient phosphorus but is low in calcium, the level of calcium in the blood serum can be raised by an increase in the calcium of the diet and by the administration of cod or other fish liver oils and to a lesser extent of butter fat. When the diet is high in calcium, low in phosphorus, and contains just enough of the antixerophthalmic vitamin to protect the eyes of the experimental rats, the inorganic phosphorus content of the serum can be raised by feeding fish liver oils and butter but not by vegetable oils (olive and maize), by withholding all food for a period of time, and by exposing the animals to radiations from various sources.

Studies on the etiology of beriberi, K. OHMORI, Y. OHHASHI, H. NAKANICHI, M. HARA, and T. OTA (*Japan Med. World*, 2 (1922), No. 5, pp. 128–133).—Several cases are reported of aggravation of mild beriberi by the use of a diet deficient in vitamin B and of the prompt cure of the disease by the administration of oryzanin, an extract of rice polishings.

ANIMAL PRODUCTION.

Readings in evolution, genetics, and eugenics, H. H. NEWMAN (*Chicago: Univ. Press*, 1921, pp. XVIII+523, figs. 101).—This book has been prepared to serve as a textbook for a course in evolutionary biology, and consists of con-

tributions from many of the leading workers in subjects pertaining to evolution, genetics, and eugenics.

Crossing over involving three sex-linked genes in chickens, A. S. SEREBROVSKY (*Amer. Nat.*, 56 (1922), No. 647, pp. 571, 572).—Crossing Plymouth Rock females with Orloff males at the Institute of Experimental Biology, Anikova, Russia, gave evidence of the occurrence of crossing over between the genes of the sex chromosomes in the females in a manner similar to that noted by Haldane (*E. S. R.*, 46, p. 769). The sex-linked factors employed were a factor which retards the development of feathers, and two factors which cause barring. These factors being dominant in the Plymouth Rock and recessive in the Orloff, the F_1 males resembled Plymouth Rocks and the F_1 females were black, due to the nonsex-linked melanic factor carried by the Plymouth Rocks. In the F_2 generation new forms were observed which resulted from the breaking up by crossing over of the three factors linked with the sex chromosomes.

Studies on inheritance in pigeons.—IV, Checks and bars and other modifications of black, S. VAN H. JONES (*Genetics*, 7 (1922), No. 5, pp. 466–507, figs. 13).—This is another study in the series on inheritance in pigeons (*E. S. R.*, 42, p. 764) from the Wisconsin Experiment Station, and deals with the method of inheritance of blue and black. The range in color from full black birds to the type known as barless in which the bird is nearly all blue is divided into six grades, which are attributed to the action of the factors S, T, C, So, and Ba arranged in an epistatic series. S is the highest member of this series and produces black over the entire body, irrespective of the presence of the other factors. When S is recessive, T produces a blue tail in an otherwise black bird (black blue-tail). With S and T recessive, C confines the black pigment to spots in the wing coverts (check). With S, T, and C recessive, So maintains only a sprinkling of black in the wing coverts (sooty). With S, T, C, and So recessive, Ba confines the black to the wing bar region (barred). and with all these factors recessive, a barless bird is produced.

Any of the types lower in the series may be produced from matings of birds carrying factors higher up, but none of those types higher in the series can be produced by matings of those lower in the series. There were a few exceptions to this, however, in the experiments. The presence of the B factor which produces black pigment is of course necessary for the action of the epistatic series. The relation to the A factor which is sex-linked and restricts black was not determined.

In studying the cause of uniform and light outer vanes of the outer tail feathers, it was found that with S the presence of a factor called U produced uniform coloring of the tail feathers, whereas the allelomorph of U produced the light outer vanes. In the presence of s the action of U could not be distinguished. The variation in rump color from blue to black tailed was divided into five grades, but the controlling factors of each were not determined, it being concluded that these conditions were due to a complicated interaction of factors independent of the epistatic series. A nonsex-linked factor D was determined as the cause of the deep black color, whereas the allelomorph d produced a dull black.

A note on the inheritance of the steel coat color in rabbits, H. ONSLOW (*Jour. Genetics*, 12 (1922), No. 1, pp. 91–99).—The author reports several experiments in crossing Dutch rabbits having a steel coat pattern, from which he determined that a heterozygous condition of a factor X converted an agouti into a steel. In the homozygous condition the X factor was found to change an agouti to a black. This black, however, differed genetically from the normal black, which is recessive for both the agouti factor and the X

factor. Reference is also made to the fact that there may be more than one type of agouti and steel.

On the inheritance of color in a fresh-water fish, *Aplocheilichthys latipes*, with special reference to sex-linked inheritance, T. AIDA (*Genetics*, 6 (1921), No. 6, pp. 554-573, pl. 1).—The results of several experiments with a Japanese fish are reported in which the methods of inheritance of the different skin colors have been studied at the Higher Technical School, Kyoto, Japan. From the results of this study the author attributes the different colors to the following factors: R which produces yellow pigment or an orange-red color and which is linked with the X or Y chromosomes, and B which produces black pigment over the whole body, thus with R producing a brown-black and with r a blue-black fish. When both B and R are recessive a white fish results. A factor B' allelomorph to B and b produces black pigment in parts of the body, thus with R an orange-red variegated with black and with r a white variegated with black are produced.

The most interesting part of the results of crosses were the exceptions to the expectations which occurred. The author attributed part of the abnormalities to a crossing over of the R factor from the X to the Y chromosome, which is the first case of this occurrence ever reported. Examples of this were given, as when white females (rX) (rX) were mated to orange-red males (RX) (RY) the offspring were all red. When these F₁ males (rX) (RY) were mated back to white females the offspring expected were white females (rX) (rX) and red males (rX) (RY), but there occurred 251 red males, 197 white females, 2 red females, and 1 white male. Where heterozygous red females (RX) (rX) were mated with heterozygous red males (RX) (rY) the offspring were 146 red females, 57 red males, 80 white males, and 2 white females. Nondisjunction as it occurs in *Drosophila* would not explain the latter case, for if the red male were of the formula (RX) (O) no white females could be produced, whereas the theory of crossing over will explain the exceptions in both cases.

Mating heterozygous brown males Bb (rX) (RY) to white females gave 286 brown males, 328 blue females, 206 red males, and 208 white females as was expected, with exceptions of 2 brown females and 1 blue male which the author could not explain by crossing over.

A fourth allelomorph in the albino series in mice, H. W. FELDMAN (*Amer. Nat.*, 56 (1922), No. 647, pp. 573, 574).—The author reports the occurrence of a new mutant mouse which is due to a character allelomorph to albinism, and which is similar to the mouse reported by Detlefsen (*E. S. R.*, 46, p. 268), thus appearing to be a fourth allelomorph in the albino series. The allelomorphs may be designated as C for wild color, c^r for dilute as described in this paper, c^d extreme dilute as described by Detlefsen, and c for complete albinism.

Studies on the cells of sheep with special reference to spermatogenesis, oogenesis, and sex determination, J. E. WOODSEDALEK (*Abstr. in Anat. Rec.*, 23 (1922), No. 1, p. 103).—In sheep the chromosome number in the spermatogonia and the somatic cells of the male was found to be 33, as compared with 34 in the oogonia and the somatic cells of the female. One-half of the spermatids contained only 16 chromosomes, while the other half contained an additional sex chromosome. The egg cells also contained 16 autosomes and 1 sex chromosome.

Further observations on chromosomes and sex determination in *Abraxas grossulariata*, L. DONCASTER and R. C. BAMBER (*Quart. Jour. Micros. Sci.* [London], n. ser., 66 (1922), No. 263, pp. 397-408).—In a previous paper¹ the

¹ Jour. Genetics, 4 (1914), No. 1, pp. 1-21.

inheritance of a tendency to produce families consisting almost entirely of females was described. It was found that the females in such families have 55 chromosomes, while all males and most other females have 56. It was assumed that in the unisexual families the eggs matured in such a way that 28 chromosomes were extruded in the first polar nucleus, and 27 remained in the egg nucleus which united with the sperm and thus produced females with 55 chromosomes. Further cytological studies, however, have disproved this idea and have shown that the polar nucleus receives the 27 chromosomes as often as it receives the 28.

Evidence is also presented to show that the lack of males in these families is not due to a lethal factor, since in a number of almost exclusively female families about two-thirds of the eggs were reared to adult age. During the first polar division a mass of deep staining granules have been observed to be left in the equatorial plate when the chromosomes travel to the poles, and it is suggested that this material may be chromatin which has been eliminated from the 28-chromosome egg and thus reduced it to a female-forming egg, by making the sex chromosome functionless or by eliminating it. An account is also given of the stains used in carrying on this work.

Contribution to the knowledge of sex in bees, G. JEGEN (*Schweiz. Bienen Ztg.*, n. ser., 44 (1921), No. 6, pp. 217-221; abs. in *Internatl. Inst. Agr. [Rome]*, *Internatl. Rev. Sci. and Pract. Agr.*, 12 (1921) No. 9, pp. 1183, 1184) --Observations made during the maturation of the sperm cells in bees indicate that some of the sperms contain 8 chromosomes, whereas others contain 9 chromosomes. It is suggested that the males may not be due to unfertilized eggs as is usually considered, but rather to eggs fertilized by the 9-chromosome sperms, which only occurs when food and temperature are correct.

Some notes on the gametogenesis of *Ornithorhynchus paradoxus*, J. B. GATENBY (*Quart. Jour. Micros. Sci. [London]*, n. ser., 66 (1922), No. 263, pp. 475-496, pls. 3, fig. 1) --This is a description of oogenesis in the duck-billed platypus of Australia.

A critical study of the facts of artificial fertilization and normal fertilization, J. GRAY (*Quart. Jour. Micros. Sci. [London]*, n. ser., 66 (1922), No. 263, pp. 419-437, fig. 1) --This is the discussion of the part played by the egg and sperm cells in fertilization, and is largely confined to Loeb's theory of artificial parthenogenesis and Lillie's theory of fertilization. The sperm cell by fertilization activates the egg cell which would otherwise remain more or less inactive. The secretions of the egg in certain cases also tend to increase the activity of the male gametes.

Are permanent disturbances of equilibration inherited? C. R. GRIFFITH (*Science*, 56 (1922), No. 1459, pp. 676-678).--In experimental work at the University of Illinois rats were rotated in small cages from 60 to 90 times per minute for several months. After removing these rats from the cages some showed changes in bodily movement such as circular movements about the nest and turning or twisting the head to one side. Some of the offspring of the disequilibrated rats, even in the third generation after rotating, exhibited these characteristics. Further studies are being made on the inheritance of these conditions.

Alcoholism and the growth of white rats, E. C. MACDOWELL (*Genetics*, 7 (1922), No. 5, pp. 427-445, figs. 3).--The effects of alcohol fumes on the growth of male rats is reported as previously noted (*E. S. R.*, 48, p. 306), and in addition the weights at similar ages of the female rats treated in a like manner are given and shown to be in agreement with the results of the studies with males. The weights of the females were not as accurate as the males, due to the effect of pregnancy on weight. Alcohol seems to have a tendency to retard the

normal rate of growth and a tendency to prevent the reproduction of those females bearing weaker growth genes, and so to raise the average weight of the individuals in the next generation after treatment.

Prickly pear as stock feed, F. SMITH (*Roy. Soc. Queensland, Proc.*, 33 (1921), pp. 1-29).—This is a review of feeding experiments with the common pest pear, *Opuntia inermis*, carried on at the Wallumbilla Experimental Farm, Queensland, during 1916 with steers as previously noted (E. S. R., 38, p. 774), and during 1917 with dairy cattle and sheep. The prickly pear seemed to have a place in the ration of steers or dairy cattle which were not too well fed, but with too heavy feeding, due to the lack of palatability, an insufficient amount was consumed to make it of value. In no case was the prickly pear recommended to be fed as the sole ration. For sheep prickly pear may be fed finely cut, but it is not eaten well when much of any other feed is given, and it is not adapted for fattening lambs or milking ewes.

On the use of woody materials in live-stock feeding.—III, Studies of grapevine shoots and hemp, F. SCURTI and G. DROGOU (*Staz. Sper. Agr. Ital.*, 55 (1922), No. 1-3, pp. 13-23).—In continuing the studies previously noted (E. S. R., 45, p. 774), the authors found that treating grapevine shoots and hemp with sulphuric, hydrochloric, and nitric acids of different strengths under pressure resulted in maximum sugar contents of 31.2 per cent in the grapevines and 27.93 per cent in the hemp. The maximum cellulose content of the samples used before treatment was 71.58 and 68.66 per cent, respectively.

On the use of woody materials in live-stock feeding.—IV, The nutritional value of the treated products, F. SCURTI and V. VEZZANI (*Staz. Sper. Agr. Ital.*, 55 (1922), No. 1-3, pp. 24-28).—The products resulting from the treatment of corncobs and wheat straw by methods noted in previous reports have been compressed into cakes and fed to cattle, hogs, rabbits, chickens, ducks, and geese with comparative success. From 10 to 50 per cent of the rations were made up of these materials.

An electrical method of green forage preservation (*California Sta. Rpt.* 1922, p. 59).—By treating alfalfa and foxtail silage in 3 30-in. tiles with a 220-volt alternating current of electricity, F. W. Woll and A. H. Hoffman made a preliminary study of the Schweizer electrical method of preserving green forage. After one and two months the material was found in good condition upon opening, except for a little decay at the top and around the walls of the tiles. Cattle ate the silage without waste.

The acid content of preserved feeds, E. HASELHOFF (*Fühling's Landw. Ztg.*, 71 (1922), No. 7-8, pp. 121-130).—This is a discussion of the volatile and nonvolatile acid content of fermented green feeds, followed by the presentation of data showing the extreme variations in the volatile acid content of samples of preserved feeds made from grasses, clover, alfalfa, vetch, beet leaves, and mixtures of green feeds, depending upon different conditions and methods of preservation.

Inspection of commercial feedstuffs, P. H. SMITH, E. M. BRADLEY, and J. T. HOWARD (*Massachusetts Sta. Control Ser. Bul.* 19 (1922), pp. 3-34).—The usual results of analyses of the feeding stuffs inspected for the year ended September 1, 1922, are given (E. S. R., 47, p. 274). An article advocating home-mixed rations for dairy cattle is also included.

Inspection of commercial feeding stuffs, H. R. KRAYBILL, T. O. SMITH, and C. P. SPAETH (*New Hampshire Sta. Bul.* 205 (1922), p. 51).—A brief discussion of the principles of animal feeding is followed by the usual analyses of feeding stuffs officially inspected for the year 1922 (E. S. R., 46, p. 674).

Commercial feeding stuffs, September 1, 1921, to August 31, 1922, B. YOUNGBLOOD ET AL. (*Texas Sta. Bul.* 303 (1922), pp. 5-192).—This is the

usual report of the results of the inspections of feeding stuffs (E. S. R., 46, p. 675) for the year ended August 31, 1922. Analyses of the various feeding stuffs, definitions, and general information are also included.

Range cattle [experiments at the California Station] (*California Sta. Rpt. 1922, pp. 54-56, figs. 2*).—In continuation of the beef cattle range experiments previously noted (E. S. R., 47, p. 660), the following average gains per head were determined for the different classes of cattle on summer mountain range during 1921: Dry cows and 2-year-old helpers 79.33 lbs., calves 184.9, 2-year-old steers 61.5, yearling steers 57.24, yearling helpers 49.1, and cows with calves at foot a loss of 79.1 lbs.

In a steer feeding trial conducted by G. H. True, C. E. Howell, and G. H. Wilson, 3 lots of 24 2-year-old grade Shorthorn steers each and 1 lot of 25 yearling grade Shorthorns were fed chopped alfalfa hay with supplements as follows for 90 days: Lot 2 sorghum silage, lot 3 sorghum silage and a limited amount of barley, and lot 4 sorghum silage, barley, and cottonseed meal. At the end of 90 days the steers in lots 1 and 2 were not fit to market, so all lots received the same ration as lot 4. The steers were finally marketed by picking the 50 best, 15 of which came from each of lots 3 and 4, 7 from lot 1, and 13 from lot 2, and 27 days later the rest of the animals were disposed of. Nine thin steers from lot 3 and 6 helpers from lot 4 were sold at a lower price. The cheapest gains were made on hay and silage during the test and the costliest with the grain rations. The cost of the gains made by the yearlings was approximately one-half that of the 2-year-olds. The yearlings went to market averaging 793 lbs. as compared with 914 lbs. for the older cattle.

Steer feeding experiments, 1921-22, C. W. HICKMAN and E. F. RINEHART (*Idaho Sta. Circ. 28 (1922), pp. 3-8, fig. 1*).—In continuation of the steer feeding tests previously noted (E. S. R., 45, p. 674), a 100-day test with 73 2-year-old steers divided into 7 lots is reported. In this test long and cut alfalfa, with limited or full feeds of corn silage, barley, or both were compared. All lots received alfalfa hay ad libitum, but in lots 2 and 5 the hay was cut. In addition to the alfalfa the different lots received the following amounts of feeds per 1,000 lbs. live weight: Lots 1 and 2, 5 lbs. barley; lots 3 and 5, 15 lbs. corn silage; lot 4, 25 lbs. of corn silage; lot 6, 5 lbs. of barley and 25 lbs. of corn silage; and lot 7, 10 lbs. of barley and 15 lbs. of corn silage. The following table gives a summary of the test:

Summary of steer-feeding test.

Lot.	Average initial weight.	Average daily gain.	Feed consumed per 100 lbs. gain.			Feed cost per 100 lbs. gain.	Esti- mated order of finish.
			Alfalfa.	Corn silage.	Barley.		
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		
1.....	924.70	1.62	2,015.9	.....	325.3	\$7.97	3
2.....	945.33	1.93	1,419.0	.....	282.6	7.51	2
3.....	952.64	1.41	1,928.2	1,139.2	.....	7.10	7
4.....	966.53	1.55	1,772.4	1,751.9	.....	7.93	6
5.....	951.70	1.67	1,764.7	1,020.4	.....	8.22	4
6.....	942.23	1.82	1,358.3	1,464.0	295.1	8.98	5
7.....	962.21	2.02	896.3	807.5	538.7	8.70	1

At the end of the test part of the steers were not properly finished, so that it was necessary to add grain to the ration of all. The estimated order of finish of the different lots at the close of the test is given in the table.

Feeding beef cattle, R. S. CURTIS (*N. C. Agr. Col. Ext. Circ. 134* (1922), pp. 18, figs. 7).—This is a discussion of the principles of feeding cattle for slaughter, with a few pointers on management and types of animals to be chosen.

Feeding experiments at the Government cattle farm, Hissar, R. BRANFORD and E. SEWELL (*Agr. Research Inst., Pusa, Bul. 130* (1922), pp. 13).—Feeding experiments are reported in which rations of gram, guar, til (*Sesamum indicum*) seed cake, mustard-seed cake, and a mixture of oats, gram, guar, and bran were fed with karbi jowar hay, and oats bhoosa (straw) and long hay at different periods to 5 lots, totaling 10 working bullocks and 15 unbroken animals with comparative success in all cases. Guar also proved to be a satisfactory feed for donkey stallions and yearling ewes, as well as most of the other feeds used above.

Prickly pear: Its value as a fodder for sheep in droughts and in ordinary times, A. STEAD and E. N. S. WARREN (*Union So. Africa Dept. Agr. Bul. 4* (1922), pp. 12, figs. 3).—A 267-day experiment is reported from the Grootfontein School of Agriculture in which 10 3-year-year-old wethers averaging 95 lbs. in weight were fed on rations made up largely or entirely of prickly pears. The pears were cut into pieces about 1½ in. long and 1½ in. wide, and were fed in troughs.

At nearly all times when the pears were fed alone the wethers lost more or less weight, but by including some lucern hay the weight was maintained or increased. From 10 to 15 lbs. of prickly pears were consumed per day by the wethers. No water was given the wethers after the fifth day, and an appended note states that 4 animals had been without drinking water except as received from the pears consumed for 525 days. The value of the prickly pears in times of drought as a source of water and food is brought out, it being noted that sheep may be kept alive for long periods on prickly pears alone. With the addition of feeds containing sufficient protein to the ration good gains were made.

Lamb feeding experiments, 1921-22, C. W. HICKMAN and E. F. RINEHART (*Idaho Sta. Circ. 29* (1922), pp. 3-8, fig. 1).—The results of the fifth year's lamb feeding investigations (E. S. R., 45, p. 674) are reported, the purpose of which was to compare corn, barley, and a mixture of wheat and oats; cut and long alfalfa hay; limited and full feeds of corn silage; and to determine the advisability of feeding barley to lambs only after the first 30 days of fattening. In all, 489 lambs, which had been pastured for 41 days on alfalfa stubble, making daily gains of 0.32 lb. per lamb, were divided into 7 lots for the test, which lasted 73 days. All lots received long alfalfa hay ad libitum except lot 6, in which the hay was cut. The additional feeds consisted of lot 1 barley and 2.5 lbs. corn silage per head daily, lot 2 barley and 1 lb. of corn silage per head daily, lot 3 shelled corn, lot 4 wheat and oats (3:1), lot 5 barley after the first 30 days, and lots 6 and 7 barley.

The fattened lambs were shipped to Chicago soon after the conclusion of the test. The shrinkages of the different lots were determined at Kirkland, Ill., where the lambs were held for 6 days. The table following gives a summary of the test.

Summary of 1921-22 lamb feeding experiments.

Lot.	Lambs per lot.	Average initial weight.	Average daily gain per head.	Feed consumed per 100 lbs. gain.					Waste hay.	Feed cost per 100 lbs. gain.	Shipping loss per head.
				Alfalfa hay.	Corn silage.	Barley.	Corn.	Wheat and oat mixture.			
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Per ct.	\$	Lbs.
1.....	70	74.68	0.357	1,045.8	454.8	193.8	.....	.....	29.8	\$5.27	4.12
2.....	70	76.98	.295	1,408.2	262.9	235.5	.....	.....	27.5	6.17	3.50
3.....	69	75.11	.357	1,255.6	.....	.....	197.3	.....	25.7	5.61	2.67
4.....	67	74.21	.314	1,597.5	.....	.....	.....	230.6	19.4	6.82	3.50
5.....	69	75.27	.314	1,441.5	.....	181.7	.....	.....	24.5	5.24	7.42
6.....	69	75.67	.279	1,172.6	.....	220.4	.....	.....	13.1	6.09	2.01
7.....	69	73.20	.328	1,291.1	.....	214.3	.....	.....	20.2	5.16	2.73

Studies in sheep breeding [at the California Station] (*California Sta. Rpt. 1922, pp. 59, 60*).—In addition to the material previously noted in the sheep breeding experiments (E. S. R., 47, p. 669), J. F. Wilson has arrived at the following conclusions and collected such data as appear below:

There is no relation between the age of a ewe and the birth weight of her lambs. Twin ewes at 1 year old averaged 128.2 lbs., whereas singles at the same age averaged 131.9 lbs. The average weights of ewes varying from 448 to 476 days of age were Rambouillets 131.7 lbs., Hampshires 141.4, Shropshires 127.7, Romneys 126.6, and Southdowns 108 lbs. The relative prolificacy of the different breeds was as follows: Rambouillet 65.38 per cent, Hampshire 36.66, Shropshire 27.78, Southdown 50, and Romney 57.14 per cent. The average birth weights of lambs were for all lambs 9.16 lbs., single rams 10.17, twin rams 9.37, single ewes 9.5, twin ewes 8.18, rams twin of a ewe 9.04, and ewes twinned with a ram 8.08 lbs. The average birth weights of the lambs of the different breeds were Rambouillets 9.85 lbs., Hampshires 9.32, Shropshires 8.55, Southdowns 8.72, and Romneys 9 lbs.

Sheep raising industry in the twelfth Federal reserve district, its present condition and problems, J. PERRIN (*Fed Reserve Bank San Francisco Spec. Rpt. 3 (1921), pp. 15, figs. 3*).—This is primarily a statistical study of the sheep industry in the States of Washington, Oregon, Idaho, California, Nevada, Utah, and Arizona, with special reference to the methods of financing the industry and the conditions which existed in 1920 and 1921.

Rice and rice by-products for fattening swine (*California Sta. Rpt. 1922, pp. 56-58*).—In two trials to determine the feeding value of rice and rice by-products conducted by E. H. Hughes and Mead, 8 lots of 10 pigs each were self-fed in dry lot the following feeds with tankage in each lot: Lot 1 rolled barley, lot 2 rough rice, lot 3 rice polish, lot 4 rice bran, lot 5 rice polish and rice bran, lot 6 rolled barley and rough rice, lot 7 rolled barley and rice polish, lot 8 rolled barley and rice bran. The first trial lasted 63 days and the second trial 70 days.

From the results of the tests which are summarized below, it is concluded "that feeding whole dry rough rice with tankage is a practice of doubtful value. The feeding of rice by-products in combination with tankage and barley, on the other hand, produced good market hogs economically."

Summary of trials using rice and rice by-products with tankage for fattening hogs.

Lot.	Trial.	Average initial weight.	Average daily gain.	Feed consumed per 100 lbs. gain.				
				Tankage.	Rolled barley.	Rough rice.	Rice polish.	Rice bran.
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1.....	1	120.73	1.83	35.20	428.00			
	2	87.00	1.61	40.61	425.29			
2.....	1	115.43	1.29	132.20		356.20		
	2	89.60	1.03	159.50		356.80		
3.....	1	113.87	1.97	47.51			306.78	
	2	90.73	1.49	52.00			311.30	
4.....	1	114.31	1.71	65.36				347.86
	2	88.93	1.15	96.30				348.80
5.....	1	115.47	1.77	15.10			300.80	58.51
	2	88.07	1.44	47.10			301.70	32.30
6.....	1	118.92	1.62	32.84	364.00	53.86		
	2	87.60	1.62	37.50	364.70	78.20		
7.....	1	130.83	2.09	20.04	328.50		84.96	
	2	88.87	1.66	30.80	217.90		157.50	
8.....	1	102.60	1.95	18.70	322.56			73.90
	2	83.20	1.66	31.70	307.40			105.00

Feeding the brood sow, J. M. EVVARD and C. C. CULBERTSON (*Iowa Sta. Circ. 81* (1922), pp. 4).—A popular discussion of the principles of feeding brood sows is given, with special reference to the results of experiments which have emphasized the necessity of adequate sources of protein in rations consisting largely of corn.

Saving the orphan pigs, J. M. EVVARD and G. V. GLATFELTER (*Iowa Sta. Circ. 80* (1922), pp. 11).—Suggestions are given for raising orphan pigs, based on the results of the experiments previously noted (*E. S. R.*, 47, p. 777).

The pig industry: A neglected source of national wealth, A. J. PERKINS (*So. Aust. Dept. Agr. Bul. 164* (1921), pp. 20).—This is a description of the pig industry in Australia. Statistics are given showing the number of pigs in Australia, the imports of pork and pork products by Great Britain, and the exports of these products by Canada and the United States.

Marketing American pork in England, E. C. SQUIRE (*U. S. Dept. Agr., Bur. Agr. Econ., Foreign Sect. Rpt. 27* (1922), pp. 19).—This is a description of the manner in which American pork and lard are marketed in England with reference to the expenses involved and the preferences of the British trade.

An article on the proportions of the horse, L. VAN MELDERT (*Ann. Gembloux*, 28 (1922), No. 6, pp. 198-208).—The body measurements of four American trotters having records for the mile under 2 minutes—Peter Manning, Uhlan, Lee Axworthy, and Arlon Guy—are discussed and compared with the body measurements of three French trotters—Fushla, Conquerant, and Normand.

[Experiments with poultry at the California Station] (*California Sta. Rpt. 1922*, pp. 140-145).—To test the palatability of White Yolo, 120 White Leghorn hens and 6 males were fed in the morning a scratch feed in straw litter composed of equal weights of wheat, milo, White Yolo, and barley for 30 days. In the evening these feeds were self-fed in individual hoppers. During a second 30-day period the feeds were placed only in the hoppers, which were open from 4 p. m. to 8 a. m. A dry mash was self-fed at all times

during both periods. The birds were found to be leaving the barley until last. The ration consumed by the birds from the four hoppers was made up of 35 per cent wheat, 30 per cent yellow milo, 27 per cent White Yolo, and 8 per cent barley. Because of barley's lower cost, however, it was concluded that it is profitable to use it for feeding poultry over 3 months of age.

J. E. Dougherty, S. S. Gossman, and F. W. Woll, by using hydrolyzed tannery waste containing 44.7 per cent protein in addition to barley and wheat bran, found that rabbits receiving the tannery waste made a little more rapid gains than the others, but they also consumed more feed, which made the cost of gain practically the same in both cases. White Leghorns receiving the tannery waste laid 10 per cent less eggs and made 9 per cent less gains than others which received an equal amount of meat scrap in place of the tannery waste.

In studying the correlation between physical characters and egg-laying ability in poultry certain facts have been observed by W. E. Lloyd and Gossman. Redness of comb and thickness of pubic bones are of the least value in indicating egg-producing capacity of a hen, while the distance between the pubic bones, abdominal capacity, size of vent, and shank color are the most reliable indications of laying capacity. Most of the physical characters were found to increase in value for classifying hens for egg production with advance of the laying season. The size of the comb and paleness of the shank, beak, ear lobe, and vent in summer were of value for determining good and poor layers. In estimating the laying capacity of a hen, however, it is necessary to weigh all the physical characters together.

In comparing brooders heated by electricity, coal oil, coal, and gas heated hot water, Lloyd found the electrically heated brooder the most economical in labor and fuel consumption when filled to a reasonable capacity. The brooders burning coal oil, however, were thought to be the most adaptable to all conditions.

Lloyd found that the more finely built birds were very little better layers than coarser boned birds by dividing pullets into two lots, placing those of medium to large abdominal capacity, medium to fine quality of bone, and full and soft in the abdomen in the fine typed lot.

In marketing studies with rabbits and poultry, Lloyd found that the shrinkage varied from 2.8 to 16 per cent. The average cost of marketing in percentage of the price per pound received was determined for the different classes of poultry and rabbits as follows: Rabbits 24 per cent, hens, and old roosters 20.8, young poultry 23.8, capons 19.4, and turkeys 17.1 per cent.

At the Southern California Farm Bureau egg-laying contest a feeding test comparing milk products with meat scrap for laying hens was carried on. The comparative number of eggs laid per hen from November 1 to April 1, were, respectively, with meat scrap 73, buttermilk 84, dried skim milk 79, semisolid buttermilk 63, semisolid buttermilk 70, dried milk albumin 79, semisolid buttermilk and meat scrap 67, and with meat scrap and lactein 65 eggs.

Digestible nutrients of poultry feeds as determined by laboratory feeding tests, B. F. KAUPP and J. E. IVEY (*Poultry Sci.*, 2 (1922), No. 1, pp. 1-9; also in *Natl. Poultry Jour.*, 3 (1923), No. 137, pp. 454, 455, 456).—In experiments to determine the digestibility of feeds by poultry at the North Carolina

Experiment Station, the following results were obtained for each feed as tabulated:

Coefficients of digestibility for poultry.

Feed.	Number of trials.	Organic matter.	Crude protein.	Fat.	Crude fiber.	N-free extract.
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Barley.....	5	76.46	75.90	66.45	4.33	84.52
Buckwheat.....	8	70.14	56.79	55.09	6.33	82.69
Clover (calculated).....	3	27.70	70.60	35.50	.....	14.80
Corn.....	18	86.43	81.05	83.23	5.86	90.55
Corn, cracked.....	2	83.30	72.20	87.10	.....	88.10
Corn meal (bolted).....	5	84.67	74.04	96.26	6.66	88.18
Corn meal (unbolted).....	3	83.21	73.50	84.50	6.80	87.60
Corn meal.....	5	84.20	74.60	89.80	.....	89.30
Cottonseed meal.....	4	73.32	81.94	79.05	5.46	82.92
Cowpeas.....	6	71.90	.....	88.70	.....	87.50
Oats.....	19	63.52	73.85	80.22	11.69	74.37
Oats, hulled.....	5	81.75	69.83	84.57	4.91	86.22
Oats, rolled.....	4	89.30	80.10	92.20	.....	94.30
Kafir corn.....	11	83.50	68.56	76.96	4.45	90.60
Millet.....	2	.....	62.40	86.70	.....	98.40
Potatoes.....	6	78.30	46.90	.....	.....	84.50
Peanut meal (fat not extracted).....	5	65.94	80.35	78.41	4.08	84.14
Pears.....	3	76.60	88.10	81.20	.....	87.10
Rice.....	5	69.17	73.08	80.00	5.31	78.93
Rye.....	4	77.65	71.56	25.05	4.68	84.19
Soy bean meal (fat extracted).....	5	77.61	83.33	81.41	2.16	83.14
Wheat.....	10	80.68	69.82	48.78	6.40	87.73
Wheat bran.....	3	46.70	71.70	37.00	.....	46.00
Wheat middlings.....	18	52.55	64.52	53.59	8.45	54.81
India wheat.....	3	72.70	75.00	83.80	.....	93.40
Meat scrap.....	4	83.60	91.40	91.00	.....	.....
Blood meal.....	4	88.71	88.10	78.36	.....	71.55
Buttermilk (dried).....	5	80.79	81.55	78.01	.....	81.14
Fish meal.....	5	91.60	91.48	92.24	.....	.....
Meat and bone meal.....	2	86.82	92.17	93.13	3.23	76.56
Tankage.....	2	85.50	90.70	91.71	3.94	81.88

The digestibility of the feeds indicate that poultry make very little use of fiber, and those feeds showing the greatest digestibility of organic matter were generally those low in fiber content. Since the grains and mill by-products are deficient in sodium, chlorin, calcium, and phosphorus, it is suggested that 1 per cent of salt and 5 per cent of ground bone or bone meal be added to the mash, which should be made up of about 20 to 25 per cent animal products, 50 per cent corn meal, some ground oats, and a smaller amount of wheat middlings. About 1 oz. of green feed per adult bird should also be given daily.

Feeding farm poultry, O A BARTON and G W. McILROY (*N. Dak. Agr. Col. Ext. Circ. 54* (1922), pp. 10, figs. 3).—A general description of the methods of feeding laying hens, fattening poultry, and baby chicks is given.

The winter time management of the laying flock, W. C. THOMPSON (*New Jersey Sta. Circ. 145* (1922), pp. 32, figs. 28).—This is a general discussion of the methods of feeding, management, and handling of laying hens during the winter.

Changes in egg production in the station flock, H. D. GOODALE and R. SANBORN (*Massachusetts Sta. Bul. 211* (1922), pp. 99-125, figs. 16).—This is the report of experiments begun in 1912 to improve the egg production of the breeding flock of Rhode Island Reds at the station. Five main characters have been recognized as influencing fecundity, i. e., age of maturity (age of laying first egg), rate of production (winter and annual), broodiness, point at which production ceases, and length of winter pause. Many factors probably control each character. The original birds in the flock in 1912 were deficient in vitality and poor breeders, so that it was first necessary to remedy these defects

largely by crossing. The flock hatched in 1915, however, were an improvement in these respects, but were in general poor in the five characters controlling egg production, though some individuals were better than others in regard to one or more of those characters.

Beginning in 1916, female breeders were primarily selected for early maturity, and the success obtained is best observed in the table showing the decrease in average age of laying the first egg during the different years. An effort was next made to reduce broodiness in the flock by crossing with a low broody strain developed in the experiments noted (E. S. R., 44, p. 870). At the same time some progress was made in reducing winter pause and increasing rate of laying. The males used in the experiments were selected by choosing the most vigorous ones from large families on the basis of the mother's record and the sisters' records. The results of the experiments show that marked improvement has been made in the flock by increasing the rate of maturity and annual and winter egg production, as shown in the table below. No selection was made for early maturity after 1917.

Changes in mean winter and annual egg production and age of laying first egg in certain of the flocks.

Year.	Winter egg production		Annual egg production.		Age of laying first egg.	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation.
	<i>Eggs</i>	<i>Eggs</i>	<i>Eggs</i>	<i>Eggs</i>	<i>Days.</i>	<i>Days.</i>
1913-14	36.70±0.88	17.05±0.62	145.41±3.04	34.66±2.15	255.62±1.13	21.68±0.80
1915-16	29.86±.76	17.40±.51	124.21±1.87	40.20±1.32	263.69±1.50	34.61±1.06
1918-19	63.61±1.27	19.62±.90	170.02±2.52	29.89±1.78	194.58±1.38	24.23±.97
1920-21	67.34±1.38	24.88±.94	200.99±2.57	39.78±1.82	200.44±1.38	26.50±.98

Selection against the winter pause has reduced its length, but this is somewhat dependent upon the time of first laying, since late maturing birds frequently did not show any winter pause. The date of last egg and the summer production were largely dependent on broodiness.

It is recommended for practical improvement of a flock that one character be worked with at a time. First breed for birds that will lay under 200 days of age, then eliminate broodiness, next increase November and December production to 22 eggs, then winter production to 80 eggs, after which other characters may be worked with such as size of eggs, color of eggs, etc. Vigor should always be carefully maintained in the flock.

The correlation between the egg production of the various periods of the year in the Rhode Island Red breed of domestic fowl, J. A. HARRIS and H. D. GOODALE (*Genetics*, 7 (1922), No. 5, pp. 446-465, figs. 7).—A study of the comparative correlation between the monthly egg production and the yearly egg production for the pullets in the Rhode Island Red flock at the Massachusetts Experiment Station for the years 1915-16, 1916-17, and 1917-18 gave similar results during the different years and for the entire period.

The conclusions drawn from the study were in general in agreement with those on White Leghorns previously noted (E. S. R., 46, p. 575). It was determined that the correlation between the egg production of individual months tends to decrease as the months are more widely separated in time, and that correlation between the egg production of autumn and winter months at the beginning and end of the pullet year is greater than the correlation between the production in these months and the production in the spring and summer months.

Report of egg-laying contests for 1922, R. R. HANNAS and F. H. CLICKNER (*New Jersey Stas., Hints to Poultrymen*, 11 (1922), No. 3, pp. 4).—Preliminary reports of the second and third years, respectively, of the Bergen County and Vineland International egg-laying and breeding contests are given. Previous contests have been noted (E. S. R., 46, p. 877).

The fur industry of the Far Eastern Republic (*Washington, D. C.: Spec. Deleg. Far Eastern Republic, 1922, pp. 13, pl. 1*).—This includes lists of the fur-bearing animals found in the Far Eastern Republic and regions adjoining it, as well as data showing the furs produced annually for a number of years and copies of the laws regulating trade in furs.

DAIRY FARMING—DAIRYING.

The relative value of sunflower silage and corn silage for dairy cows (*California Sta. Rpt. 1922, pp. 58, 113*).—In a test to compare sunflower and corn silage conducted by F. W. Woll, W. E. Tomson, and L. W. Ingham, dairy cows received sunflower silage cut at early bloom during the first and third periods of 4 weeks each and corn silage during the second period of the feeding experiment. Four lbs. of a grain mixture of rolled barley, wheat bran, coconut meal, and cottonseed meal (5:3:1:0.5) were fed per pound of butter fat produced. One week's transition period was allowed between the changes of feed.

Sunflowers were not a desirable silage crop, since the cows only ate an average of 15 lbs. per head per day as compared with the daily consumption of 31.2 lbs. of corn silage. The analysis of the sunflower silage showed 80.67 per cent water, 0.11 per cent fixed and 0.1 per cent volatile acidity.

The average content of fixed acid was determined by M. E. Jaffa and H. Goss as 1.45 per cent for corn silage, 0.95 for alfalfa silage, 1.49 for sorghum silage, and 0.25 for sunflower silage.

Oats and vetch v. corn or sunflowers for silage, R. C. JONES (*Oregon Sta. Bul. 194* (1922), pp. 5-20, figs. 2).—Since oat and vetch have been found to nearly equal sunflowers in yield for silage, three years' experiments have been carried on to determine the comparative value of corn, sunflower, and oat and vetch silage for feeding dairy cattle.

Each year 2 lots of cows were fed for 30 days on a ration containing each kind of silage, with 10-day transition periods for changing the rations. The author expressed the milk-producing value of corn silage as 100 and found the comparative value of oat and vetch silage to be 105.3 and sunflower silage to be 98. The sunflower silage was more or less unpalatable, especially to some cows, but the oat and vetch and corn silages were equally palatable.

Determinations were made of the flavor of the butter made from milk produced by the cows while on the different silage rations, melting point of the fat, etc. Only slight differences were observed, the iodine number of sunflower butter being a little higher and a slight feed flavor being noticed in one sample of the butter made from milk produced by cows receiving sunflower silage. Per cubic foot oat and vetch silage was found to weigh about four-fifths as much as corn or sunflower silage.

The feeding of dairy cows (*Min. Agr. and Fisheries [London], Leaflet 388* (1922), pp. 10).—The feed requirements of dairy cattle are briefly presented, with directions for balancing rations based on the digestible protein and starch equivalent content of the ration. A table shows the digestible protein and starch equivalent in the more common dairy feeds.

Conditions in Europe, W. W. FISK (*N. Y. Prod. Rev. and Amer. Creamery*, 55 (1922), No. 9, pp. 369-373).—This is a description of the methods of dairying in England, France, Switzerland, Denmark, and Holland.

The National Society of Dairying (*Soc. Natl. Latt. Rap.* 1921, pp. 26+27).—This is the annual report of the secretary of this society for the year 1921. Discussions are given on the hygienic production and care of milk, pasteurization, control of diseases carried by milk, and composition of milk. The appendix includes a report on milk hygiene by Van Huffelen, the veterinary inspector. A copy of the constitution of the society is also given. The report is published in full in both Dutch and French.

Standard score card, R. S. SMITH (*Milk Dealer*, 12 (1923), No. 5, pp. 26, 28, 30, 32, 34).—This discussion of the milk score card deals especially with the advisability of continuing to use 4 per cent butter fat as a perfect score for milk.

Market milk, E. KELLY and C. E. CLEMENT (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd.*, 1923 pp. XVII+445, figs. 121).—This book takes up in detail the problems of producing and distributing market milk. Among the subjects covered are the food value of milk; diseases likely to be carried by milk; the composition and chemical properties of milk, together with factors likely to influence the composition; factors influencing bacterial count, pasteurization, and the methods of destroying bacteria; farm and city milk inspection; scoring milk and cream; items entering into the cost of milk production and distribution; supplying the consumer with milk by city milk dealers and producers' cooperative milk distributing organizations; the methods of shipping milk; arrangement, construction, equipment, and operation of the milk plant; standardization, clarification, homogenization, and emulsification of milk; and types and care of refrigeration machinery.

The appendix contains much information of practical value, dealing with such subjects as New York City milk standards, dairy statistics, equipment for a milk laboratory, by-laws of a producers' dairy company, etc., as well as outlines of a series of suggested exercises for use in connection with studies of the different chapters of the book.

The milk problem, H. SCURFIELD (*Jour. State Med.*, 31 (1923), No. 1, pp. 28-40).—This is a discussion of the possibilities of milk in carrying tuberculosis and other diseases. Pasteurization and the testing of cows, together with sanitary handling of the milk, are recommended as methods of increasing milk consumption with the resulting betterment to human health.

[**Studies of gelatin at the California Station**] (*California Sta. Rpt.* 1922, pp. 77, 79).—G. D. Turnbow found marked variation in the jellying and melting properties of different samples of gelatin when 1.5 gm. of gelatin was dissolved with water to make 100 cc. of solution, the samples heated to 160° F., and then allowed to set at 50°. The results were checked by placing this gelatin in a water bath at 100° and the time required for dissolving recorded. The number of bacteria per gram in gelatin were found to vary in different samples from 2,000 to 33,000,000. The samples with the higher bacterial counts seemed to have lower jellying strengths.

Yeasts and molds in sweetened condensed milk, S. KNUDSEN (*K. Vet. og Landbohøjsk. [Copenhagen]*, *Aarskr.* 1922, pp. 282-295; *abs. in Abs. Bact.*, 6 (1922), No. 9, p. 450).—In experimental work carried on in the biochemical laboratory of the Polytechnic Institute at Copenhagen, two yeasts have been isolated from fermented cans of sweetened condensed milk. Both yeasts fermented glucose, fructose, and saccharose, but not galactose, maltose, or lactose. No gas was formed in the milk unless a fermentable sugar was added, but in such cases rapid fermentation occurred and the milk coagulated. Other types of yeast were found in Danish and Dutch sweetened condensed milk. An English abstract accompanies the article.

Butter workmanship, O. F. HUNZIKER (*Chicago Dairy Prod.*, 29 (1923), Nos. 39, pp. 24, 32; 40, pp. 29, 32).—In an address presented before the Oregon Buttermakers' Association, the author has discussed some defects in the body, texture, color, and saltiness of butter and attributes the cause of these defects to poor butter workmanship. Suggestions for overcoming most of the defects are to see that the cream is held at churning temperature long enough to become thoroughly chilled, that the pasteurization temperature is not too high, that the cooling afterward is rapid, that all butter is worked evenly, and that a proper amount of salt is added to it.

The effect of composition on overrun, O. E. WILLIAMS (*Ice Cream Trade Jour.*, 18 (1922), No. 11, pp. 71-73; also in *Creamery and Milk Plant Mo.*, 11 (1922), No. 11, pp. 100, 102, 84; *N. Y. Prod. Rev. and Amer. Creamery*, 55 (1923), No. 10, pp. 414-417).—Studies at the Dairy Division, U. S. D. A., have shown that increased amounts of fat, sugar, or gelatin in the ice cream mix tend to reduce the overrun which occurs during freezing. Egg albumin, lactic acid, and milk solids-not-fat tend to increase the overrun, though in the case of the milk solids-not-fat too great an amount in the mix was found to decrease the overrun. The limitation to the amount of lactic acid used would be determined by the flavor.

The utilization of dairy products, L. A. ROGERS (*Butter, Cheese, and Egg Jour.*, 13 (1922), No. 50, pp. 10-12, 14-16; also in *N. Y. Prod. Rev. and Amer. Creamery*, 55 (1922), Nos. 7, pp. 272, 273; 8, pp. 310-312).—This is a discussion of the different methods of disposing of skim milk, buttermilk, and whey by manufacturing them into such products as skim-milk cheese, cottage cheese, casein, evaporated, powdered, and condensed skim milk, semisolid and dried buttermilk, solidified whey, and milk sugar. The equipment required for making each of these by-products is described.

Dairy produce factories, L. T. MACINNES (*Agr. Gaz. N. S. Wales*, 33 (1922), No. 9, pp. 647-652).—A discussion is given of the details to be considered in the construction of a dairy manufacturing plant with reference to a suitable location, materials used in the construction, necessary equipment, and operation for the production of dairy products of the best grade.

VETERINARY MEDICINE.

[Investigations of diseases of animals at the California Station] (*California Sta. Rpt.* 1922, pp. 163-167, 172, 173, 174, 175).—In a careful study of the animals at the certified dairy of the university, at Berkeley, J. Traum and G. H. Hart failed to detect the presence of *Bacillus abortus* notwithstanding the fact that there was clinical evidence of the abortion disease. In another herd of 10 animals in which 3 heifers had aborted within a short space of time, agglutination tests of sera gave negative results. In an agglutination test made 10 weeks later negative results were again obtained in the heifers and all other animals, indicating that the abortion in this herd was due to causes other than *B. abortus* infection. The studies of Traum and Hart indicate a localization of *B. abortus* in the supramammary lymph nodes of cattle and emphasize the fact that single negative agglutination tests are not to be taken as definite evidence of the disappearance of *B. abortus* from the body of infected animals.

Experiments during the year with *B. abortus* in swine led to the following conclusions: "Injection of live organisms into the testicles of boars causes the appearance of agglutinins in the blood and abscess formation in the testicle. The germ can be isolated from such artificially infected testicles up to at least 4 weeks after injection. Following castration of such artificially infected boars

the agglutinating titer of the serum drops within 2 to 4 weeks to negative in 0.02 cc. of serum. *B. abortus* (Bang) has not been found to become established in boars after subcutaneous injections of live cultures. No lesions have been found in the testicles, and the positive blood serum becomes negative after an interval of approximately one month. In boars the subcutaneous injection of dead suspensions of *B. abortus* (Bang) produces agglutinins in about 7 days, as do the live cultures, but they disappear within 2 weeks after reaching their maximum production. A positive reaction to the agglutination test indicates active infection in the hog, and a decline in the titer of the serum to negative in 0.02 cc. of serum, if continued over 30 days, indicates the disappearance of the infection. *B. abortus* (Bang) does not live in the normal nongravid womb of gilts for more than 2 weeks after being introduced artificially. It may persist, however, as long as 4 weeks when associated with pyogenic bacteria and the presence of a metritis."

A case of lymphangitis in cattle caused by the Preisz-Nocard bacillus is briefly reported upon by Traum. He, in cooperation with K. F. Meyer, also definitely proved that one of two cows which succumbed within a period of 2 weeks suffered from parturient malignant edema, i. e., vibriosis infection.

A serious outbreak of fowl cholera in a flock of 30,000 ducks, in which losses had been heavy for about 6 weeks and the mortality in the last week from about 100 to 200 ducks a day, being entirely confined to birds from 4 to 10 weeks old, was investigated by J. R. Beach. The disease was controlled by eliminating raw meat from the ration and replacing it by a much smaller quantity of meat scrap.

In comparative tests made by Corl and Cushman of buttermilk, "semisolid" buttermilk, hydrochloric acid, lactic acid, catechu, and sulphocarbolates for the control of coccidiosis, it was found that buttermilk feeding combined with proper sanitation and care gave the best results. Severe outbreaks of nutritional disease of poultry, investigated by Carpenter, were controlled by the feeding of green food.

Important diseases affecting live stock in Northern Territories, W. P. B. BEAL (In *Report on the Live Stock Industries of the Northern Territories of the Gold Coast Colony. Akkra: Gold Coast [Vet. Dept.], (1920), pp. 33-38*).—This report includes accounts of the occurrence of anthrax, lung plague or contagious bovine pleuropneumonia, contagious foot rot, epizootic lymphangitis, filariasis, fowl cholera, piroplasmosis, rinderpest, hemorrhagic septicemia, and trypanosomiasis.

Annual report of the Bengal Veterinary College and of the Civil Veterinary Department, Bengal, for the year 1921-22, A. D. MACGREGOR and P. J. KERR (*Bengal Vet. Col. and Civ. Vet. Dept. Ann. Rpt. 1921-22, pp. 3+II+8+IX+2*).—This is the usual annual report (E. S. R., 46, p. 479).

Autocæsarean section in a mouse, J. F. BALDWIN (*Jour. Amer. Med. Assoc., 80 (1923), No. 2, p. 128*).—The author reports observations of an autocæsarean section in the mouse. This is said to be the first record of such.

Some attempts to control strongyles in aneurisms by means of intravenous injections of drugs, M. C. HALL and J. E. SHILLINGER (*Jour. Amer. Vet. Med. Assoc., 62 (1922), No. 3, pp. 353-356*).—This is a report of preliminary work conducted by the authors. The results thus far obtained have been largely negative.

Practical notes on the inoculation of large animals—intravenous, subcutaneous, intraperitoneal, and intraspinal, A. PANCERA (*Clin. Vet. Rass. Polizia Sanit. e Ig. [Milan], 45 (1922), No. 11, pp. 387-397, figs. 8*).—Practical

directions, with illustrations, are given for the technique of inoculating animals by various routes.

Studies on the disease of guinea pigs due to *Bacillus abortus*, W. A. HAGAN (*Jour. Expt. Med.*, 36 (1922), No. 6, pp. 697-709, figs. 4).—This paper reports a general study of the pathogenicity of *B. abortus* for guinea pigs, the work being preliminary to the investigation reported in the next paper.

An attempt was first made to determine the minimum amount of culture needed to produce infection regularly in guinea pigs on intraperitoneal inoculation. From plate counts of the dilutions regularly causing infection, it was estimated that somewhat less than 100 organisms are required to infect most animals. The animal proving most resistant to infection was finally infected by a dose furnishing less than 10,000 organisms.

To determine the effects of variations of dosage on the character of the resulting infection, a series of animals was inoculated in three groups, one with a heavy, another with a medium, and third with a very small dose. All of the animals were bled weekly for determinations of agglutinin titer, and from each group one was killed and examined at intervals of 1, 4, 6, and 9 weeks after the inoculation.

The principal difference noted in the three groups was in the time relation. Large doses of the infecting organism caused earlier agglutinin production and earlier lesions, while small doses produced the same effect at a much later period. This point is further brought out in a comparison of the agglutination curves over a considerable period of time of animals receiving small and moderate doses of living cultures. In general a fall in the agglutination titer began at about the tenth week of the infection, but in the group receiving very small infecting doses the disease was still actively progressing at this time.

Other points brought out in this study are that the virulence of *B. abortus* cultures for guinea pigs may be raised or lowered by appropriate passage through these animals, that agglutinins for *B. abortus* are capable of passing the placental filter, and that the danger of normal guinea pigs becoming infected through ingestion of *B. abortus* or through association with diseased animals of their own sex is relatively slight.

The value of heat-killed cultures for the prevention of the *Bacillus abortus* inoculation disease of guinea pigs, W. A. HAGAN (*Jour. Expt. Med.*, 36 (1922), No. 6, pp. 711-725, figs. 4).—In discussing the literature on attempts at immunizing guinea pigs against *B. abortus* infection, the work of Ascoli (*E. S. R.*, 36, p. 481) and of Stafseth (*E. S. R.*, 44, p. 878), particularly the latter, is criticized on the ground that the infecting doses employed were so massive as to overcome any ordinary degree of immunity. With this in mind, the present investigation was planned to detect if possible in the inoculated animals immune processes which might not be of sufficient degree to afford complete protection.

Twenty-four half-grown female animals weighing about 350 gm. each were selected for the test. Half of these were given intraperitoneal injections of 1 cc. of a killed bacterial suspension of *B. abortus* weekly for 6 weeks, and at the end of the third week following the last dose both groups received inoculations of the living culture in three different dilutions, one approximating the minimum amount necessary to produce infection, one a moderate, and one a comparatively high dose. All of the animals were bled at weekly intervals for agglutination determinations, and 1 of each group was killed 3, 6, 9, and 12 weeks after the inoculation. A comparison was made in corresponding animals from the uninoculated and inoculated groups of changes in body weight, differences in agglutination curves, extent and character of

the lesions, especially in the size and condition of the spleen, and the number of *B. abortus* organisms cultivable from the spleen.

During the entire experiment the average gain in body weight was approximately the same for the two groups, 308 gm. for the immunized and 304 gm. for the nonimmunized, as compared with an average gain of 430 gm. for 2 animals used as controls which received no treatment other than periodic bleeding for agglutination tests. During the period of immunization the animals being immunized did not gain weight so rapidly as those not being immunized, while after the inoculation of the living cultures the reverse was true.

The agglutination curves showed the same delay in agglutinin production with the smaller doses noted in the previous paper, but no difference in the agglutination response to the infecting doses in the immunized and non-immunized groups.

All of the inoculated animals became infected, but certain differences were noted in the character of the lesions in the spleen, lymph glands, and kidneys. Enlargement of the spleen, while occurring in both cases, was much greater in the nonimmunized than in the immunized group, this difference being evidently a matter of degree only. An appreciably greater number of *B. abortus* organisms was found in the spleen of the nonimmunized than of the immunized animals. Enlargement of the lymph glands was also more pronounced in the nonimmunized animals. Cellular infiltration of the kidneys, followed by sclerosis, occurred in the nonimmunized, but with one exception not in the immunized animals.

The author concludes that, in confirmation of the work of previous investigations, guinea pigs can not be rendered immune to *B. abortus* inoculation disease by treatment with heat-killed cultures of this organism, but that the progress of the disease can be delayed appreciably by such treatment.

An appendix to the paper contains descriptions of the author's technique in bleeding guinea pigs for agglutination tests and in determining the approximate numbers of *B. abortus* present in the spleen.

The susceptibility of mice and rats to infection with *Bacillus abortus*, W. A. HAGAN (*Jour. Expt. Med.*, 36 (1922), No. 6, pp. 727-733).—White mice have been found to be quite as susceptible as guinea pigs to infection by inoculation with *B. abortus*, and are recommended as an inexpensive substitute for guinea pigs in diagnostic work.

Both mice and rats were found to be refractory to infection with *B. abortus* by ingestion, although the feeding of large amounts of culture occasionally resulted in infection in rats. "The difficulty of infecting rats and mice with *B. abortus* by feeding makes it very doubtful whether these animals can have any rôle in the propagation and spread of infectious abortion in cattle."

The manufacture of antirinderpest serum in the Philippine Islands, T. TOPACIO (*Philippine Agr. Rev.*, 15 (1922), No. 3, pp. 229-236).—The two methods employed in the Philippines for the preparation of antirinderpest serum are described and their relative merits discussed. The first is the usual method of preparing hyperimmune serum by subjecting susceptible cattle first to an injection of from 5 to 15 cc. of rinderpest virus, together with from 50 to 400 cc. of the serum. When the animals have recovered from the reaction a second injection of 25 cc. of virus is given, followed at intervals of a week by doses of virus of 100, 500, and from 2,500 to 3,500 cc., another dose of from 2,500 to 3,500 cc., and a final dose of 1,500 cc. The animals are then bled for serum three times at intervals of one week. The serum is filtered through sterile gauze, allowed to settle for 3 or 4 days, and bottled with either 0.5 per cent phenol or 0.1 per cent formalin as preservative.

In the second method the serum is obtained from animals which have recovered from simultaneous inoculation with from 10 to 25 cc. of virulent blood and 50 cc. of reactor serum. The animals must have shown definite clinical symptoms or a febrile reaction consisting of from 39.5 to 40° C. and above for 3 or 4 days consecutively. Seven days after the reaction, when the temperatures have returned to normal, the reactors are bled 3 liters each and 3 days later are bled to death, the two bleedings averaging from 2,000 to 4,000 cc. of serum. The serum is filtered through double sterile gauze into sterile demijohns, 0.1 per cent formalin is added, and after the serum has been allowed to settle for several days it is bottled by siphoning from the demijohns and kept in cold storage.

Field tests are reported which indicate that there is no appreciable difference in the efficiency of the two serums, and that the second or reactor serum has the advantage of being cheaper and more readily prepared.

The protective dose of antirinderpest serum for the simultaneous immunization of native carabaos is from 300 to 500 cc. and for imported breeds a still larger amount. Immunization of carabaos against rinderpest with the simultaneous method has given good results in districts where the disease is purely endemic, but the serum-alone treatment has been found to be inefficient as a general field measure.

The use of antirinderpest serum in the field, H. F. KERN (*Philippine Agr. Rev.*, 15 (1922), No. 3, pp. 241-245).—Practical suggestions are given for the use of antirinderpest serum. Attention is called to the variations in potency of the serum, depending upon the course of the reaction in the animal furnishing it, the length of time elapsing after recovery before the animal is bled, and the conditions under which the serum is kept before use. The use of serum is advocated for noninfected animals in a herd in which the disease is running a mild course, but not for noninfected animals which are in no danger of becoming infected for two or three weeks, on account of the fact that the passive immunity thus secured does not last for more than two or three weeks.

The amount of serum required for immunization varies with the locality and with the size and age of the animals. In the case of highly susceptible animals from 300 to 450 cc. of serum is recommended for cattle and from 400 to 500 cc. for carabaos.

Tuberculin testing of live stock, L. B. ERNEST and E. LASH (*U. S. Dept. Agr., Dept. Circ. 249* (1922), pp. 28, figs. 11).—This circular deals with the various tuberculin test methods recognized for use by the Bureau of Animal Industry, U. S. D. A., and by various State officials. The tests include the subcutaneous, intradermic, and ophthalmic tests, either alone or in combination. The nature of each test, directions for its application, suggestions for the interpretation of doubtful results, and the advantages and disadvantages of the test are discussed, with illustrative charts and photographs. The combination tests treated are the intradermic-ophthalmic-subcutaneous, subcutaneous-ophthalmic, intradermic-ophthalmic, and intradermic-subcutaneous. Indications for the use of each are given, with directions for its application.

Brief directions are also given for the tuberculin testing of swine and fowls, the identification of all animals tested, the post-mortem examination of reacting cattle, and necessary work following tuberculin testing.

The intradermal tuberculin test for poultry (*California Sta. Rpt. 1922*, pp. 173, 174).—Following an intradermal tuberculin test made by J. R. Beach and Carpenter on an infected flock of 757 fowls, 103 were found to be reactors. The reactors were disposed of and the remaining birds kept in the same house,

which was cleaned but not disinfected. While new yards were provided, the birds still had access to the old yards and manure pile. Six months later a second test was made on the same flock which had been increased to 858 birds by new additions. Of these, 81 reacted, all but 3 of which were from the original flock. In making the test from 0.1 to 0.5 cc. of a 50 per cent solution of concentrated avian tuberculin was injected under the skin of the wattle.

In the first test the readings were made at 48 and 72 hours and in the second at 24 and 48 hours. Since 14 per cent of the birds showing a positive reaction in 24 hours in the second test were negative at 48 hours, it is thought that some reacting birds were overlooked in the first test. The essential cause of the continued spread of the disease is considered to be due, however, to the general lack of sanitary precautions. The results are thought to show that but little headway in eradicating tuberculosis from a flock of chickens can be gained by simply removing the reactors to the tuberculin test.

Tuberculosis eradication under the accredited herd plan (*California Sta. Rpt. 1922, pp. 167, 168*).—Tuberculosis eradication under the accredited herd plan has been begun in four certified dairies, the work being done in cooperation with the Bureau of Animal Industry, U. S. D. A., and the State bureau of animal industry. In two of the largest dairies comprising a total of 1,515 animals, the combination ophthalmic-intradermal test, with temperature readings from the eighth to the eighteenth hour, was applied to 1,064 adult animals and the intradermal test alone to 451 young animals. There was a total of 47 reactors, including 3 of the young stock given only the intradermal test. Of the remaining 44, 3 gave the ophthalmic reaction only, 4 the temperature reaction only, 19 the intradermal reaction only, and 18 the intradermal reaction with some evidence of ophthalmic reaction. In a third herd of 283 animals, 111 young and dry animals were given the intradermal test only and 172 adult animals the combination ophthalmic-intradermal test. In this herd there were in all 28 reactors, including 4 among those given the intradermal test alone. Of the remaining 24, 8 gave an intradermal reaction only, and 16 an intradermal and ophthalmic reaction.

Of the reactors in the first two herds, 16, including the 3 given the intradermal test only, were killed without finding any lesions of tuberculosis. Of the reactors in the third herd, 3 reacting to the intradermal test and 10 to the combination test were slaughtered and lesions found in 4 animals, including 1 given the intradermal test alone.

It is considered that the failure of some of these tests to agree with the post-mortem findings may be due to the tuberculin used. The need is emphasized for a critical study of the method of manufacturing tuberculin with a view to standardizing the process so that it may be eliminated as a possible factor in conflicting results.

Bovine tuberculosis in Canada (*Agr. Gaz. Canada, 10 (1923), No. 1, pp. 24-27*).—This is a discussion of the control measures now in effect in Canada, including eradication work under the accredited herd system.

A vaccine against sheep pox obtained by the action of ethyl ether, N. MORI (*Gior. Med. Vet., 71 (1922), No. 39, pp. 619-625*).—The author reports considerable success in the preparation and use of a vaccine against an atypical form of sheep pox which caused a large percentage of deaths among sheep in certain districts in Italy. The vaccine is prepared by filtering through a filter candle the virus obtained from infected animals and subjecting it for a period of from 8 to 10 days to the action of ethyl ether. This vaccine when injected subcutaneously into healthy animals causes at the most only a slight edema and rise in temperature, and appears to protect the animals against natural

and artificial infection. The immunity thus secured lasts for 4 or 5 months and perhaps longer.

Field and laboratory studies of infectious enteritis in young pigs and the efficiency of bacterins in the control of this disease, G. E. JORGENSEN (*North Amer. Vet.*, 3 (1922), No. 12, pp. 642-646).—A few field and laboratory studies on infectious enteritis in young pigs are reported briefly. Eight broods of young pigs in two different herds were treated, as outlined below, with a pig scour bacterin containing *Bacillus suispestifer*, *B. enteritidis*, *B. coli communis*, *B. paratyphosus* A and B, and the paracolon bacillus.

In one brood of 9 pigs, 2 of which developed a malignant form of enteritis the day after birth and died the following day, the remaining animals were given 2 cc. of the bacterin, following which only 1 developed the disease. Among the organisms isolated from the blood, spleen, and gall bladder of the infected cases were identified *B. suispestifer* and *B. paratyphosus*. Another brood of 6 pigs received the same bacterin, and the disease did not develop in any of the animals. In a third brood of 11, all but 1 of which were immunized, none developed the disease. Another brood of 4 received no injection, and all contracted the disease and died. A final brood of 7 in the same herd received the bacterin, with one exception. The latter animal contracted the disease and died, while the bacterinated animals remained well.

In another herd two unvaccinated broods contracted the disease and died, and a third brood of 4 received the bacterin and remained well. In another brood of 9 pigs, of which 3 showed symptoms of enteritis when born, the remainder received the bacterin and none developed the disease. In a final brood of 10 all but 2 received the bacterin and remained well, as did 1 of the 2 receiving no treatment, while the other developed the disease and died.

The laboratory experiments were conducted on rabbits and young pigs. Rabbits inoculated intraperitoneally with the organisms recovered from some of the fatal cases of scours died with one exception, and in each case the organisms were recovered from the animals after death. Of another series of rabbits which received a preliminary immunization with the commercial pig scour bacterin and were then inoculated with the same organisms, all lived with one exception. In similar experiments upon young pigs, animals fed virulent cultures of the same organism died with the exception of the ones inoculated with *B. paratyphosus* and streptococci, while all but one of another group receiving 2 cc. of the bacterin before being fed the cultures did not contract the disease.

Fowl cholera associated with ruptured ova (*California Sta. Rpt.* 1922, pp. 171, 172).—In a flock of 2,700 1-year-old pullets 231 died within 4 months, and on autopsy by Carpenter over half of these birds showed ruptured ova in the abdominal cavity. In 14 of the birds showing ruptured ova and in 4 that did not, the fowl cholera organism was found in the heart and liver. Attempts to induce the disease in a few fowls by subcutaneous inoculation with cultures of the organism or by feeding the organs of dead birds proved unsuccessful.

An investigation of the value of bacterins for controlling fowl cholera was conducted by J. R. Beach and Carpenter on a flock of 1,000 1-year-old pullets among which from 5 to 8 birds were dying daily with evidence of *Bacterium avisepticum* infection. One-third of the flock received commercial fowl cholera bacterin, one-third an autogenous bacterin prepared from cultures obtained from the flock, and the remaining one-third served as controls. The bacterins were given in 2 1-cc. doses at intervals of a week, and the ration of the fowls was considerably reduced. In 2 weeks following the vaccination, 8 of the birds receiving the commercial bacterin, 2 the autogenous bacterin, and 10 of the controls died. Half of the survivors of the groups receiving the commercial

bacterin and half of the controls were then given 2 1-cc. doses of the autogenous vaccine. No difference was noted subsequently in the number of deaths for the various groups, but attempts to increase the ration always resulted in more deaths. It is concluded that fowl cholera bacterin is of no value in controlling the disease.

Preliminary results obtained by Beach in experiments in which laying hens were inoculated subcutaneously with *B. avisepticum* show that this organism may localize in the ovary. Following the subcutaneous inoculation of 12 hens there were 2 deaths, 1 on the third and 1 on the fourth day. Three of the remaining birds were killed on the fifth, sixth, and eighth days, respectively. In the hens which died yolk from ruptured ova was found in the abdominal cavity and *B. avisepticum* was recovered from the heart, liver, abdominal cavity, yolks, and undeveloped ova in the ovary. In 2 of the 3 hens killed, the organism was found in the yolks and undeveloped ova, but not in the heart or liver.

Chicken pox (epithelioma contagiosum) (*California Sta. Rpt. 1922, p. 171*).—The value of a second vaccination for chicken pox in flocks where the disease continues to be prevalent 4 or more weeks after the first vaccination was tested by Carpenter, who revaccinated three flocks consisting of 2,753 birds. In all of these flocks the disease disappeared within 3 weeks following the second vaccination. In another flock in which the disease was just starting, 266 were vaccinated and 283 were left as controls. Following the vaccination 9.7 per cent of the vaccinated and 28.2 per cent of the controls contracted the disease.

RURAL ENGINEERING.

[Irrigation experiments at the California Station] (*California Sta. Rpt. 1922, pp. 104-107, figs. 4*).—Studies by F. J. Veihmeyer and S. H. Beckett on the losses of moisture from cultivated and uncultivated uncropped irrigated soils, including sandy soil, dense clay, silt, sandy loam, and clay loam soil containing gravel, showed that the differences in the losses of moisture between cultivated and uncultivated soils are so small that they fall well within the limit of probable error. No loss of moisture by lateral movement was detected. No significant difference in the distribution of moisture was noted to a depth of 20 in. in the cultivated and uncultivated soils.

In similar experiments with clay loam soil in potometers, the loss of moisture by evaporation directly from the surface for three months during the summer was very small and was not affected by cultivation. Tanks containing soils the surfaces of which were uncultivated lost no more than tanks containing soils the surfaces of which were cultivated to depths of 6, 8, and 10 in. Additional observations, both with potometers and in the field, showed that the loss of moisture from cultivated and uncultivated soils was confined almost entirely to the surface foot.

Field and potometer observations on transpiration losses by Veihmeyer and A. H. Hendrickson indicated that the moisture lost directly by evaporation from the surface of the soil is negligible as compared to the water required for the support of a crop. Observations by Veihmeyer to determine the seasonal water requirements of young prune trees showed that during the winter months, from the time the leaves drop in the fall to the beginning of activity in the spring, there was a very slight loss of moisture by transpiration. Further observations by Hendrickson and Veihmeyer indicated that moisture losses by transpiration slowed down in the early afternoon of each day.

Moisture equivalent studies by Veihmeyer, working with a thoroughly mixed and screened clay loam soil, indicated that the amount of soil used in a

moisture-equivalent determination has a marked effect upon the result obtained, the higher moisture equivalents being usually obtained with the smaller samples. Further studies on the technique of soil moisture determination are briefly described.

Irrigation practice and water requirements for crops in Alberta, W. H. SNELSON (*Canada Dept. Int., Reclam. Serv. Irrig. Ser. Bul. 6 (1922), pp. 59, pl. 1, figs. 26*).—This is a contribution from the Reclamation Service of Canada in which practical information for beginners in irrigation is given, and the different systems of irrigation and their application to conditions in Alberta are outlined. Irrigation investigations at three experiment stations to determine the duty of water for different crops in Alberta are also reported.

In studies at the Brooks Experiment Station it was found that the total depth of water used which produced a maximum yield of wheat as a mean of 12 tests was 1.9 ft. when applied in 4-in. irrigations and 2 ft. when applied in 6-in. irrigations. Under optimum fertility conditions these figures were decreased approximately 10 per cent and under poor conditions increased 10 per cent. The depth of water used which produced the maximum yield of oats as a mean of 13 tests was 1.62 ft. when applied in 4-in. irrigations and 1.8 ft. when applied in 6-in. irrigations. The depth of water used which produced the maximum yield of barley as a mean of 11 experiments was 1.67 ft. when applied in 4-in. irrigations and 1.96 ft. when applied in 6-in. irrigations. The maximum yield per acre of alfalfa was produced with a total application of water of 2.62 ft., of peas 2.25, grasses 1.5, alfalfa seed 1.48, potatoes 1.65, corn 1.36, and flax 1.34 ft.

The results of irrigation investigations at Ronalane, Alberta, and at Coaldale, Alberta, are also presented. The Coaldale data are taken to indicate that the average farmer applies an excessive amount of water per irrigation and allows too much water to escape by percolation and surface wash. The depths used at Ronalane were considerably greater than for similar crops at Brooks because of the smaller water-holding capacity of the Ronalane soil.

Data on the water-holding capacity of soils are also presented.

Increased application for the Venturi flume, H. K. SMITH (*Reclam. Rec. [U. S.], 13 (1922), No. 11, pp. 284, 285, figs. 2*).—Attention is drawn to the fact that operating conditions on an irrigation project often require that a small quantity of water be delivered through a ditch of considerably greater capacity, and at the same time it is required that the water be backed up until the ditch is practically bank full.

It is stated that the capacity of the Venturi flume, as developed at the Colorado Experiment Station and Cornell University, is limited in that the accuracy of measurement of a small discharge at a high-gauge height is doubtful. The problem is to so construct or modify the Venturi flume that an error of 0.01 ft. in gauge reading will not be material when delivering water to the farmers.

It has been found possible to overcome this difficulty by installing a plug in the throat of the flume, thereby reducing the water area. This plug consists of two weir boards bolted together, the sharp edges of both boards being toward the throat. By means of this plug a flow that in the standard design will cause a draw of from 0.01 to 0.02 ft. will cause a draw of from 0.10 to 0.12 ft., thus making the customary error of much less moment.

It is stated that four sizes of the Venturi flume are in use, having throat widths of 12, 18, 24, and 30 in. For the 12 and 18 in. sizes the height of the plug used is 9 in., and for the two larger sizes it is 15 in. These plugs

have proved quite satisfactory and are said to have greatly increased the accuracy of water measurements.

Special features on the drainage of irrigated lands, W. W. WIFE (*Agr. Engin.*, 3 (1922), No. 11, pp. 182-186).—A brief description of some of the investigational work which has been conducted at the University of California on the drainage of irrigated lands is presented. Special attention is drawn to drainage of water-logged lands by pumping. The conclusion is drawn that the removal of excess water from water-logged soils by pumping is a logical and entirely feasible method. It is essential in this process to have a well or series of wells capable of delivering a good supply of water and fitted with pumps of the proper size, and there should be a continuous use for the water.

It has been found possible by this method to lower the water table below any depth feasible by a gravity system, and more water is made available. In addition, the first cost is considerably less than that of gravity drainage. It is also applicable where gravity outlets are unavailable.

Attention is also drawn briefly to the studies at the University of California on the reclamation of black alkali soils. It is stated that so far no soils badly impregnated with black alkali have ever been entirely reclaimed. It is concluded that the only true remedy for alkali and water-logged conditions is to prevent their occurrence.

Drain cleaning, Rio Grande project, F. E. WILSON (*Reclam Rec* [U. S.], 13 (1922), No. 11, pp. 283, 284, fig. 1).—Methods used in the cleaning of drainage canals on the Rio Grande irrigation project are briefly described.

Standardized appliances for irrigation structures, J. L. SAVAGE (*Engin. News-Rec.*, 89 (1922), No. 22, pp. 923-926, figs. 4) —Designs for gates, lifts, hoists, radial gates, stems, couplings, and guides as standardized by the U. S. Reclamation Service are described and diagrammatically illustrated.

Report of the Third Interstate Conference on Artesian Water, E. F. PITTMAN, P. V. O'BRIEN, ET AL. ([*Aust*] *Interstate Conf. Artesian Water Rpt.*, 3 (1921), pp. 58, pls. 31, figs. 2).—The proceedings of the Third Interstate Conference on Artesian Water, held in Adelaide, New South Wales, in September, 1921, are presented in this report. In addition to statements of the progress of work on the development of artesian water in different parts of Australia, 16 appendixes are included dealing with the various technical and engineering features of the subject.

Surface water supply of Ohio River Basin, 1918 (*U. S. Geol. Survey, Water-Supply Paper* 473 (1922), pp. V+115, pls. 2).—This report, prepared in cooperation with the States of Illinois and Kentucky, presents the results of measurements of flow made on streams in the Ohio River Basin during the year ended September 30, 1918.

Surface water supply of the lower Mississippi River Basin, 1919-1920 (*U. S. Geol. Survey, Water-Supply Paper* 507 (1922), pp. III+49, pls. 2).—This report presents the results of measurements of flow made on streams in the Arkansas and Red River Basins during the years ended September 30, 1919 and 1920.

Stump land reclamation in Oregon, H. D. SCUDDER (*Oregon Sta. Bul.* 195 (1922), pp. 62, figs. 40).—This bulletin describes a new method of land clearing by burning stumps, and reports the results of experiments made by the station. The new method is adapted to the clearing of big stump land. The burner parts used include a furnace, hood, draft pipes, and chimney. By means of these parts a hole is burned through the base of the stump, and then the stump itself is converted into a stove, which with its own draft, chimney, and

fuel develops a fire in its interior so intense as to insure its combustion and the firing of the roots. When this is done the stump is banked in with earth, and the crown and roots are burned out below plow depth as a char pit.

It has been found that with certain minor exceptions any species of stump of reasonably sound combustible wood, of sufficient size to justify the use of fire, and with roots sufficiently large to carry a fire-well is a desirable subject for the use of the burner. The paramount value found in this method is that the bigger the stump the better it burns. The cost of burning has been found to decrease as the diameter of the stump increases. Stumps 3, 6, 9, or 12 ft. in diameter are those which the burner consumes most economically and completely. The experiments indicated that the removal of the smaller stumps up to about 18 in. in diameter is best accomplished with a puller supplemented with explosives, and that the cost of pulling the smaller stumps is economically feasible.

The experiments further showed that green stumps of any kind do not burn satisfactorily, and that the use of the burner method should not be attempted. All types of soil were used in the trials, and only the sandy type was found to be unsatisfactory. Fine sandy loams containing sufficient clay and silt to hold together when shoveled wet were found to do sufficiently well, but any type sandier than these usually made an unsatisfactory bank. The most satisfactory banking was done when the soil was moist. Detailed information is given on the procedure followed in the use of the burner method.

A second part of the bulletin describes preliminary steps in land clearing and other methods of burning and removing stumps. It is stated that the use of chemicals for the destruction of stumps has been found to be an unsuccessful method.

Killing trees and stumps with chemicals (*California Sta. Rpt. 1922, p. 96*).—Experiments conducted by W. Metcalf on the killing of trees by using the Australian arsenical formula, consisting of a mixture of 1 lb. of white arsenious oxid, 1 lb. of washing soda, and 4 gal. of water, are briefly described. The trees were girdled at or near the ground by downward cuts of the axe and the solution poured into the cuts, using a pint or less per tree. Ten species of eucalyptus, including all of those commonly planted in California, were treated with perfect success. The treatment can apparently be successfully applied at any time of year, but winter or early spring is recommended. Trees were also successfully killed by the application of the solution in holes bored about 4 in. apart around the stump.

Report of a study of the California highway system by the United States Bureau of Public Roads (*U. S. Dept. Agr., Bur. Pub. Roads, 1921, rev. ed., pp. 171, figs. 118*).—This is a revision of the report previously noted (*E. S. R.*, 45, p. 587).

Departmental committee on taxation and regulation of road vehicles in Great Britain and Ireland, H. P. MAYBURY ET AL. (*London: Min. Transport, 1920, pp. 21*).—The deliberations of this committee are presented.

Effect of 50-ton two-wheel load on concrete test road (*Engin. News-Rec.*, 89 (1922), No. 21, p. 893, figs. 2).—Final tests on the concrete pavement of the Pittsburg, Calif., test road are described, in which a 16-ton load was increased by stages up to 50 tons on two wheels. The maximum load moved over the road three times, causing complete destruction of some sections but being carried over others without delay by sinking through or breaking up of the surface.

A significant result of the heavy tonnage test was that reinforced sections 6 in. thick or unreinforced sections 8 in. thick were nowhere broken down

by the highly concentrated load, nor did they show surface signs of distress anywhere as a result. However, in making core borings, there were found many instances where the concrete in the center of the slab was disintegrated.

Cements, limes, and plasters: Their materials, manufacture, and properties, E. C. ECKEL (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1922, 2. ed., rev., pp. XXXI+655, pls. 5, figs. 153*).—This is the second revised edition of this book, which deals with the composition, manufacture, and properties of cements, limes, and plasters.

Lumber manufacture in the Douglas fir region, H. B. OAKLEAF (*Chicago: Com. Jour. Co., Inc., 1922, pp. XII+182, figs. 54*).—The purpose of this book is to present data on the methods and cost of constructing and operating plants for the manufacture of lumber from Douglas fir in the region west of the Cascade Mountains in Oregon and Washington. A special effort has been made to include information of value to mill architects and machinery manufacturers. Sections are included on general character of Douglas fir mills; site selection; sawmill plant and machinery; headsaws; cant lowering devices; edgers; slashers; trimmers; sawmill rolls and conveyors; roller band and gang resaws; cost of sawing; moving lumber within the plant; dry kilns; air seasoning and storage; planing mill; shipping; power; refuse burners; machine and blacksmith shops; fire protection; taxes; insurance; depreciation; working capital; log prices, grades, and yields; fir lumber products; and weight of fir lumber products.

Mechanical testing, R. G. BATSON and J. H. HYDE (*New York: E. P. Dutton & Co., 1922, vol. 1, pp. XIII+413, pls. 47, figs. 205*).—This is the first volume of this work, which is a number of the so-called Directly Useful Technical Series, founded by W. J. Litcham. Its purpose is to place before the technical engineer, manufacturer, and student the conditions governing modern testing, together with particulars of standard testing plants and their limitations, and such information as will enable the results obtained to be appraised at their true values. Chapters are included on load, strain, stress, and elasticity; properties of materials; testing machines; testing machine grips and shackles and the calibration of testing machines; elongation and contraction of area in the tensile test; procedure in ordinary commercial testing; mechanical tests of hard drawn wire; testing cast iron; influence of shape and time on the properties of materials; measuring instruments for the determination of the elastic constants of materials; autographic recording apparatus; determination of the elastic constants; experiments on the repetition of stresses; resistance of materials to combined stresses; rapid methods of determining fatigue ranges; alternating bending tests beyond the yield point; hardness and abrasion tests; impact and notched bar testing; effect of temperature on the mechanical properties of materials; testing of timber; testing of stone, brick, and concrete; testing road materials; and limes and cements.

A study of explosions of gaseous mixtures, A. P. KRATZ and C. Z. ROSECRANS (*Ill. Univ., Engin. Expt. Sta. Bul. 133 (1922), pp. 104, figs. 38*).—This is a preliminary report of the methods pursued and the results thus far obtained from studies in progress on the effect of varying proportions of gas and air, initial pressure, shape of explosion vessel, ratio of its volume to its area, position of ignition, and turbulence during the time of ignition upon the rate of inflammation, maximum pressure, and time of explosion of various combinations of commercial gaseous fuels in internal-combustion engines.

The studies also included tests with the temperature of ignition corresponding to the temperature found at the end of compression in different types of commercial internal-combustion engines, the purpose being to draw conclusions

relative to the effect of variations in the carbon-hydrogen ratio upon factors leading to pre-ignition in internal-combustion engines. The results with various mixtures of illuminating gas and air showed that a ratio of air to gas of about 4:1 gives the maximum explosion pressure and minimum time for explosion.

In general the effect of turbulence during explosion was to cause an increase of maximum pressure and a decrease in the time of explosion. This effect was greater for lean mixtures than for the richer ones. The maximum pressure was also produced with a slightly greater air-gas ratio than for the case where no turbulence existed. The effect of turbulence seemed to be due to the more intimate mixing of the gas and air before inflammation, thus bringing more molecules into contact, rather than to the projection of the flame into the unburned parts of the gas mixture.

The position of the source of ignition had a considerable influence on the rate of inflammation and on the maximum pressure. In vessels patterned after the L-head type of combustion space used in internal-combustion engines, ignition in the valve chamber resulted in a maximum pressure about 10 per cent less than that obtained when ignition occurred at the center of the head. Both turbulence and variations in the position of ignition seemed to have more influence upon the rate of inflammation than upon the maximum pressure.

In certain cases there was some evidence of the formation of pressure waves which travel smoothly through the mixture and produce a higher maximum pressure than if the inflammation had proceeded in the usual way. These pressure waves differed in character from true explosion waves.

The maximum pressure and time of explosion were materially affected by the shape of the explosion vessel. This seemed to be caused by variations in the ratio of surface to volume for the different vessels. From the standpoint of maximum pressure produced, the spherical explosion vessel was best. The cylindrical and conical vessels gave about the same results, but the maximum pressure was about 8 per cent lower than that for the spherical vessel. The L-head type gave results about 16.5 per cent lower than the spherical.

The combustion of the gases in any pocket in the vessel was more or less incomplete due to the cooling effect of the walls. The incomplete combustion resulted in a reduction of the maximum pressure.

The cooling of the gases for a given mixture during any time after the attainment of maximum pressure varied directly with the ratio of surface to volume of the explosion vessel, for the particular vessels used.

Radiation from the gaseous mass was an important factor in the cooling of the mixture. Variations in the character of the inner surface of the walls of the vessel caused variations in the cooling curves.

The experimental results for the maximum pressures produced by explosions of hydrogen and air agreed very closely with the values computed from the properties of the gas mixture.

Factors influencing tractor development, L. J. FLETCHER (*Agr. Engin.*, 3 (1922), No. 11, pp. 179-182, fig. 1).—A summary of a few of the many factors which are thought to have influenced the development of the tractor, with special reference to its adaptation as an agricultural machine, is presented. Particular attention is drawn to matters relating to the vaporization and distribution of low-grade fuels, cooling, lubrication, mechanical starting, and the prevention of the entrance of dust into the fuel intake.

Agricultural engineering [at the California Station] (*California Sta. Rpt.* 1922, p. 21).—Disk harrow tests by A. H. Hoffman and E. J. Stirniman, consisting of 533 50-ft. runs in three fields, showed that at speeds ranging from 0.5 to 6.1 miles per hour there was no increase in draft with an increase in

speed, and that in some cases there was a slight but definite decrease. With a set of angle of gangs of 18° , cutaway disks pulled 15.5 per cent harder than full disks. Cutaway blades broke much more readily than full blades. The draft apparently increased as the angle at which the gangs were set increased from 3 to 23° .

The Ohio multiple-unit poultry house, E. L. DAKAN and G. S. VICKERS (*Ohio Agr. Col. Ext. Bul.*, 18 (1922-23), No. 2, pp. 16, figs. 22).—General information, plans, and a bill of material for the Ohio multiple-unit poultry house are presented in this bulletin. This poultry house has been designed to meet the demands of poultry men who have a large flock or are increasing the size of their flocks. It is so arranged that it can be constructed in any multiple of the unit given. The plans shown are for one unit 25 ft. wide and 30 ft. long, and will accommodate 250 leghorns or 200 of any American class of fowls.

Lime-sulphur plants, E. H. SIEGLER and A. M. DANIELS (*U. S. Dept. Agr., Farmers' Bul.* 1285 (1922), pp. 11-41, figs. 35).—Suggestions on the building of several types of lime-sulphur cookers of different sizes, ranging from a very simple 25-gal. kettle to steam plants in which 800 gal. of the concentrate can be prepared in one cooking, are given in this section of this publication. Numerous diagrammatic and detailed illustrations are included, together with tabular data where necessary.

RURAL ECONOMICS AND SOCIOLOGY.

The cost of producing milk and dairy farm organization in western Washington, G. SEVERANCE and E. R. JOHNSON (*Washington Col. Sta. Bul.* 173 (1922), pp. 50, figs. 3).—Farms belonging to members of cow testing associations, and operated under normal conditions primarily as dairy farms, were selected for this investigation. Records were secured in the fall of 1920 for the preceding year's business on 91 dairy farms maintaining 1,502 cows which produced 10,148,381 lbs. of milk. In the fall of 1921, records for 1920 were secured from 81 dairy farms maintaining 1,469 cows and producing 10,341,074 lbs. of milk. The farms studied were located principally in the river valleys or adjoining uplands in Whatcom, Snohomish, Wahkiakum, and Pacific Counties, Wash. The method of determination of the cost of milk production on the cow basis, taking the producing herd consisting of all mature cows and the herd sire as the unit, is held to be the most generally applicable and is the one followed in this investigation.

The average cost of producing 100 lbs. of milk for the two years was \$2.81 in Whatcom County, \$2.96 in Snohomish, \$2.81 in Pacific, and \$2.68 in Wahkiakum, and the weighted average of all counties was \$2.84. The average cost of producing 1 lb. of butter fat in each county was, respectively, 64.7, 71.5, 62.3, and 63.4 cts. Feed constituted 51.99 per cent of the net cost, 49.14, 46.76, and 47.61 per cent, respectively. Man labor likewise constituted 23.52, 24.51, 20.14, and 27.39 per cent of the net cost in the counties named, respectively.

The basic requirements of feed and labor and miscellaneous expenses, as well as the variation in the net cost per 100 lbs., 1919 and 1920, are graphically presented.

In 1919, 85 per cent of the total milk produced by the herds studied cost \$3.40 or less per 100 lbs. In 1920, 90 per cent was produced at \$3.40 or less per 100 lbs.

The study indicates that the most important means of reducing the cost of production are by the use of better stock, by better feeding, and by better

labor management. It is held that material reductions may be made also in many cases by operating larger units, by better management of pastures and more attention to crop production, better planned buildings, and better utilization of manure.

Milk production costs, E. S. ARCHIBALD ET AL. (*Ontario Dept. Agr. Bul. 284* (1921), pp. 35).—The authors report the results of the cost of milk production as determined by the survey method on 64 farms in Oxford County and 50 farms in York County, Ontario. The conditions in each county are described as being quite different, Oxford County having long been a dairy section, whereas York County is new at the dairy business, with horses and hay the chief products until recently.

An analysis is made of the factors which make up the total cost of milk production, and brief calculations are given of costs based on value of feeds, labor, etc., of January 15, April 25, and September 1, 1921. The data collected are tabulated, showing the influence of the production per cow on the cost of producing milk in each county.

Some of the costs of producing 100 lbs. of milk in Oxford and York Counties, respectively, were due to requirements of 23.3 and 38.4 lbs. of grain, 52.4 and 43.4 lbs. of hay, 136.9 and 112 lbs. of roots, silage, and cornstalks, and charges for pasture of 8 and 22.6 cts., or a total feed cost of \$1.73 and \$2.07 in the two counties, respectively. Requirements for man and horse labor were 2.93 and 0.46 hours in each county. Depreciation on cows amounted to 7.6 and 11.3 cts. and on buildings and equipment to 10.4 cts. in each county. Interest charges were 12.4 and 12.8 cts., respectively, and miscellaneous costs 2.5 cts. in each county. The total cost of producing 100 lbs. of milk amounted to \$2.95 in Oxford County and \$3.33 in York County.

Milk yields, costs per gallon, and financial results, J. WYLLIE (*Scot. Jour. Agr.*, 5 (1922), No. 4, pp. 380-392, fig. 1).—This discussion is centered upon the results obtained for the year ended May 14, 1921, on 20 farms situated in the west and southwest of Scotland, all of which were wholly or largely devoted to the production of milk for sale. The unit taken was the whole dairy stock rather than merely the milking herd.

It is held that the relation between the average yield per cow day and the final net farm cost per gallon is highly indeterminate. The farm cost per gallon varied from 13.71d. to 23.4d., with an average of 17.78d. The farms that had the highest average yields had each a cost per gallon considerably under the average. From a graph in which many of these data are illustrated, a distinct tendency is noted for the milk yields to be grouped closely around the average, although the same is not true of the costs per gallon. In explanation of this, labor, feed, and live stock account factors are set forth in detail. It is found that the labor cost per gallon tends to fall as the size of the herd increases, being more closely related to this than to the milk yield per cow day. The final cost per gallon follows the net cost of feeding and maintaining the herd rather than the cost of feeding alone.

The average costs per gallon for the 20 farms are summarized as follows: Labor of production 3.15d. per gallon, or 17.7 per cent of the total; feeding and maintenance 11.42d., or 64.2 per cent; general expenses 1.02d., or 5.7 per cent; interest on capital 1.24d., or 7 per cent; and management 0.95d., or 5.4 per cent.

It is concluded that a comparison of costs per gallon on various farms is likely to prove highly misleading as to the relative economic efficiency of their management, and that a similar comparison based upon the relative net profits per gallon may be so as well, whereas a comparison of net profits per cow gives

proper weight to each of the three important factors, yield, cost per gallon, and product value.

Land problems of the new era, L. C. GRAY (*Ill. Agr.*, 26 (1922), No. 4, pp. 110, 111, 123, fig. 1).—A chart accompanying this article illustrates the increase in the population in comparison with that of improved land of the United States by decades since 1850. Some of the problems to be dealt with in developing a national land policy are pointed out.

Studies in developing farms on western South Dakota ranges, C. G. WORSHAM (*S. Dak. Dept. Agr. Circ.* 2 (1922), pp. [1]+30).—Results of the analysis of 61 farms in Jones County, S. Dak., carried out in February, 1922, are presented in 13 tables, with comment. It is intended to carry on this investigation through a period of several years, the State department of agriculture and the college cooperating.

The average size of all farms was 1,068 acres, ranging from 170 to 4,240 acres per farm. Of the total land operated 53 per cent or 568 acres were owned, and 509 acres rented, largely for cash. The average value of land owned was \$28.86 per acre, of rented land \$17.06, and of all land \$23.47. In 1921 renters paid an average of 31 cts. per acre for land. Owner operators paid 46 cts. per acre for taxes and hail insurance alone. The average cash receipts are \$1,951, of which 11 per cent was from crops, 69 per cent from live stock, 11 per cent from live stock products, and 9 per cent from outside sources. Of the average 256 acres in crop land, small grain occupied 19 per cent, corn 22, miscellaneous crops 1, tame hay 16, and wild hay 42 per cent. Only 14 farms made positive labor incomes, and one-half of these were in the group of smaller farms of 640 acres and under. While it is indicated here that in 1921 the smaller farms suffered the lightest losses, it is held that in good or normal years the opportunity for making the greatest income exists on the larger farms.

[**Rural institutions and State land settlement investigations in California**] (*California Sta. Rpt.* 1922, pp. 147-159, figs. 8).—The most important requisite for success for the settler on irrigated land is held to be a capital fund amounting to at least \$3,000 and better to \$5,000, with the provision of credit facilities to enable him to equip his holding and follow the most profitable system of farming. Two typical examples are given of what it has cost settlers on the Durban and Delhi tracts in California to buy and equip their farms, and 20 examples of what has been earned from them.

An economic study of a typical ranching area on the Edwards Plateau of Texas, R. YOUNGBLOOD and A. B. COX (*Texas Sta. Bul.* 297 (1922), pp. 437, figs. 73).—The introduction to this study is taken up with the history of ranching and some economic definitions. The area covered by the survey includes 1,437 sections in Sutton County, Texas, and 67 sections extending over into adjacent counties. Data were obtained from schedules collected in the field during the summer of 1920. The lands are described and classified. The characteristics of the land are such that ranching will continue to be the most economical use to which it may be put. The climatic data and figures on crop production, however, show that it may become possible to put the best of the tillable lands into crops for feed reserves.

The average price of the land in the area studied was about \$15 per acre. Taking eight sections as the family-sized ranch, the amount invested in real estate amounted to \$76,800. That in live stock based on the normal carrying capacity was about \$24,000. Of the 97 ranches studied in Sutton County, 25 contained 4 and under 8 sections; 19, 8 and under 12; 18, 12 and under 20; and 10 were found in each of the two groups containing 1 and under 2 and 32 sec-

tions and over. Physical, economic, political, and individual factors influencing the size of ranches are discussed. Of the 97, 60 were operated by owners, 14 by part owners, and 23 by tenants. The average length of tenure on leased land was three years.

The purchaser of a modern ranch must make a first payment of one-half to one-fourth of the purchase price, and the amount of money necessary to stock a ranch is normally about \$3,000 per section. Ordinarily it is not difficult to borrow a third to a half of this amount with the live stock as security. The average value of fences on tenant ranches in Sutton County was \$549.40 per section and on all owned ranches \$661.11. The average values of wells, windmills, rock reservoirs, dipping vats, and similar equipment were similarly \$243.20 and \$358.40.

The majority of the ranch owners were between 40 and 60 years of age, the greater number of part owners between 30 and 50, and of tenants between 20 and 40.

Vegetation and soil, water, and topography were most frequently mentioned by ranchmen in answer to the question as to the essentials of a good ranch.

Data are presented setting forth the carrying capacity units utilized in this area by cattle, sheep, and goats under several plans of range management.

In August of 1920 the estimated value of all movable capital, including live stock, crops, machinery, implements, tools, and money or credit for operating expenses, on the Sutton County ranches was \$8,120,907, the average per ranch \$83,760.69, per section \$5,424.79, per acre \$8.48, and per carrying capacity unit \$77.26. On the same date the 54 ranches operated by owners who actually owed money on their land carried an average indebtedness of \$2.71 per acre. It is pointed out that the Federal land bank does not adequately meet the needs for ranch land loans because the largest amount obtainable is too small. The principal sources of credit for loans on land are the loan companies. Cattle loan companies largely meet the demand for loans on range live stock.

Ranching is said to require an average of 2.9 men per ranch. The amount of seasonal and special labor required is much more than the total hired labor required on the average farm in Texas. Statistical information is given with regard to the number, distribution, wages, nationality, age, and the length of service of ranch hands. Ranch products are classified, and factors determining the quantity of salable products produced in a given ranching section are identified. Statistics for the 97 ranches show that over 50 per cent of the ranchmen were unable to control the time of marketing under financial pressure.

Average receipts of cattle on the Fort Worth market from 1903 to 1920 show peaks reached in May and November. Those for sheep show that the heaviest market came in May. The number of carloads of cattle received by months in 1921 reached a peak in August, but this was due to abnormal conditions.

There were 75 ranchmen in Sutton County who reported the distance they had to drive their live stock to reach the railroad. Seven drove less than 50 miles, 22 from 50 to 75, 34 from 75 to 100, and 12 100 miles or more.

Various methods of marketing live stock and live-stock products are discussed. The last chapter is devoted to a description of ranch community life and social institutions. An extensive bibliography is appended.

A treatise on the Agricultural Holdings Acts, 1908 to 1920, C. E. DAVIES, rev. by S. E. Pocock (*London: Estates Gazette, Ltd., [1921], 2. ed., rev., pp. XIX+416*).—This is a legal treatise embodying part 2 of the Agriculture Act, 1920, with forms and precedents of notices, etc., required under the acts, together with county court and Ministry of Agriculture and Fisheries rules and forms and prevailing customs of the country in England and Wales.

It constitutes a second edition of part 2 of the third edition of L. S. Wood's *Farm Valuations*, edited by G. C. Phillips and C. E. Davies.

Sale prices as a basis for farm land appraisal, G. C. HAAS (*Minnesota Sta. Tech. Bul. 9* (1922), pp. 3-31, figs. 2).—This bulletin presents a statistical method of correlating the sale prices of 160 farms in Blue Earth County, Minn., which were sold during the period of 1916 to 1919, inclusive, with the factors influencing land prices, namely, value of buildings per acre, type of land, crop yields, distance from market, size of adjacent city or village, and type of road upon which located, and of deriving an equation from which the probable sale price of any other farm land in the same territory may be determined.

The problem under value per acre was to reduce the sale prices of sales made during the 4-year period when prices were rising rapidly to a comparable basis. The differential for dirt and macadam roads was determined by cross tabulation. In the same manner the correction for the influence of towns of two classes, the first including the county seat with a population of 12,469 and several others, and the second all towns of about 500 population, was worked out. The factors of cost of buildings per acre, type of land, productivity of the soil, and distance to market were handled by partial correlation methods.

It is noted that an increase in a dollar's worth of buildings per acre increases the land value \$1.07 per acre. An increase of one point in the land classification index results in a rise in the value per acre of 73 cts. and that of one point in the productivity of soil index results in a 17-ct. increase. On a farm which is on a dirt road and adjoining a class 2 town, each mile from town decreases the land value per acre \$3.42. The extreme range in value of buildings per acre is from nothing on 40 pieces of land to \$83, the ordinary range being from \$5 to \$35 per acre, and the modal group is from \$10 to \$20. Appraisal by means of the equation worked out here involves a probable or average error of 9.55 per cent on the average sale price, or \$15 per acre. It is held to be not unreasonable to expect that this can be reduced to less than 5 and perhaps even less than 3 per cent in areas where the value is as uniform as in Blue Earth County. Applications of this method of appraisal and some of the means of decreasing the probable error are commented upon.

Appendix A gives a copy of the schedule used in gathering the data from this study and instructions for its use. Appendix B contains depreciation tables for farm buildings.

Labor organization on an East Midlands farm, A BRIDGES (*Jour. Min. Agr. [London]*, 29 (1922), Nos. 4, pp. 319-329, pls. 2; 5, pp. 447-454, pls. 2).—Labor records kept for cost account purposes on a farm in the East Midlands, England, from June 1, 1918, to May 31, 1919, are examined. The farm consists of 965 acres, 80 per cent of which is under arable cultivation. A four-course system of cropping is followed, with wheat and barley as the principal grain crops. The pasture is grazed by all classes of stock, and only 22 acres are made annually into hay. A dairy herd of from 21 to 26 milk cows is maintained, with a proportionate number of young stock. The labor supply was regular, except that casual hands and gangs were employed during busy seasons on carrots and potatoes. An average of 19 men, from 4 to 5 women, and 4 boys were regularly employed. Twenty-four working horses and 12 others were kept. The distribution of man and horse labor by months between arable, sheep, pasture, other stock, and establishment work and the competitive and complementary nature of 14 crops are graphically illustrated.

The fall in farm wages, J. WILSON (*Scot. Jour. Agr.*, 5 (1922), No. 4, pp. 403-410).—An estimate is made of changes that have taken place since a report for 1919-20 previously noted (*E. S. R.*, 46, p. 91) was published.

The present average weekly earnings of married plowmen, excluding grieves and foremen, are about 42s., as compared with 55s. in the summer of 1920 and 22s. in the summer of 1914. The laborers appear to be on the whole in a position to maintain their families at a standard of comfort at least equal to that which they had attained immediately before the war. Single plowmen have been driven by competition to submit to a larger reduction in their earnings. The average earnings of the women outworkers in the four south-eastern counties of Mid-Lothian, East Lothian, Berwick, and Roxburgh have been estimated as about 22s. per week.

There is noted a movement among farmers in several counties for an increase in the working hours.

Agricultural wages and wage earners in Denmark, V. B. TURNER (*U. S. Dept. Labor, Bur. Labor Statist., Mo. Labor Rev.*, 15 (1922), No. 5, pp. 129-138).—Danish farm hands are classed as regular and irregular workers. Unionization is said to have made the most rapid progress among them since 1915. Average wages and earnings or allowances are variously tabulated. Between July, 1914, and July, 1918, the cost of living in Denmark increased 82 per cent, while yearly earnings of agricultural workers failed to keep pace with the increased living costs. Cash wages at least continued to increase, however, with the rising cost of the family budget which reached its peak in January, 1921, at 164 per cent above the 1914 level and then began to fall, reaching 137 per cent in July, 1921. Overtime is allowed at the rate of 50 per cent for ordinary overtime and 100 per cent for Sundays and holidays as well as for night work, except for additional work in caring for live stock. Agricultural labor unions are said to claim that through the operation of collective bargaining wages and working conditions have gradually become more uniform and unemployment has decreased. The provisions of wage contracts are described.

Preparation of fresh tomatoes for market, F. E. PARSONS (*U. S. Dept. Agr., Farmers' Bul.* 1291 (1922), pp. 32, figs. 20).—This publication is based upon observations in all of the important centers of tomato production. Harvesting, grading, packing, and some marketing practices that have proved successful in commercial operations are described, together with some that have been fraught with losses.

Wholesale distribution of fresh fruits and vegetables, R. G. PHILLIPS and S. FRASER (*Washington, D. C.: Joint Council Natl. League Comn. Merchants U. S. [etc.], 1922, pp. 256, figs. 69*).—A survey was conducted by the joint council of three commission merchants and shippers' associations among large representative wholesale and commission firms at Boston, New York, Philadelphia, Pittsburgh, and Chicago, in order to ascertain the wholesale selling price of certain fresh fruits and vegetables, freight rates, the relationship between freight charges and the wholesale selling value of the commodities handled, actual handling costs, overhead, and other fixed costs, and to determine the profits or losses made by commission merchants and wholesale dealers in these commodities.

It indicated 9,476 cars shipped and distributed between September, 1920, and July, 1921. Total freight charges amounted to 32.79 per cent of the total sales and miscellaneous handling costs to 4.43 per cent. The wholesalers' gross profits on purchased and consigned goods amounted to 3.16 per cent, or an average of \$35.13 per car. The shipper is said to have received 59.62 per cent of the total sales. The wholesaler's operating expenses amounted to 5.3

per cent and a further loss of 0.257 per cent, thus leaving him actually a loss of 2.39 per cent plus interest on his capital and the salaries of himself or executive officers.

Summaries and graphic illustrations of the data are given by commodities. Transportation and exports and imports are discussed at length.

The agricultural situation in Rumania, with special reference to cereal production, L. G. MICHAEL (*U. S. Dept. Agr., Bur. Agr. Econ., Foreign Sect. Rpt. 26* (1922), pp. 1+63).—This report presents an interpretation of statistics of the acreages of cereals seeded and harvested, yields, and exports for Rumania in specified recent years. Agricultural methods are described, and a comparison is made between yields on large estates and on peasant holdings as organized since the land reforms. It is held that as a direct result of the change we may expect that for some years there will be little or no surplus of wheat for export from Bessarabia; that the exports of corn, buckwheat, millet, and possibly rye will be about what they were normally before the war; that there will be a greatly increased export of barley and oats; and that the quality of all cereals will be lower, or on the average nearly as low as the pre-war peasant standards. The subject of draft animals and machinery is briefly noted in an appendix.

Present and probable future distribution of wheat, sheep, and cattle in Australia, R. G. THOMAS (*Roy. Soc. Victoria, Proc., 34* (1922), No. 2, pp. 117-127, pls. 3).—Three dot maps are presented in connection with this paper, which discusses briefly some of the climatic and economic factors determining the present limits of the wheat belt and the distribution of sheep and cattle in Australia.

The Eighth National Congress of Mutual Aid and Cooperation in Agriculture (8. Cong. Natl. Mutul. et Coop. Agr. [Paris], 1920. *Rap. et Decis.*, pp. 80).—A number of papers on subjects pertaining to collective buying and selling, credit facilities, and insurance against accidents in agriculture are incorporated in this report of proceedings of the congress of June 11 and 12, 1920.

[**Annual reports on the working of cooperative societies in the Bombay Presidency, including Sind, 1919, 1920, and 1921**] (*Bombay Coop. Soc. Ann. Rpts., 1918-19, pp. 46+7; 1919-20, pp. 46+2; 1920-21, pp. 11+57*).—The general yearly progress and working of primary credit and noncredit agricultural societies are summarized in sections of these reports.

Farmers' telephone companies: Organization, financing, and management, I. M. SPASOFF and H. S. BEARDSLEY (*U. S. Dept. Agr., Farmers' Bul. 1245* (1922), pp. 30, figs. 3).—This aims to make available information that will assist in the extension of telephone service to rural districts now without it and in the improvement of existing rural service where improvement is needed. It deals mainly with the organization of a rural telephone company, cost of service, and problems of operation and upkeep. The appendix contains a suggestive form for constitution and by-laws and a list of commissions having jurisdiction over telephone companies.

Agriculture (*Fourteenth Census U. S., 6* (1920), pts. 1, pp. 765, figs. 23; 2, pp. 746, figs. 19; 3, pp. 423, figs. 16).—Statistics of agriculture for the census of 1920 have been collected and reports prepared under the supervision of W. L. Austin, assisted by L. E. Truesdell and S. H. DeVault. Reports for the Northern, Southern, and Western groups of States are presented in parts 1, 2, and 3, the latter including also statistics for the outlying possessions with the exception of the Philippines and the Virgin Islands. State reports are made by counties. A general summary for the United States, giving totals for the country as a whole and for geographic divisions is given in each part. The

reports for each State comprise a series of summary tables with explanatory text and five county tables showing farms and farm property, 1920, with selected items for 1910 and 1900; live stock on farms and ranges, 1920, and live-stock products, 1919; domestic animals not on farms or ranges, 1920; value of all crops and acreage and production of principal crops, 1919; and mortgage debt, 1920, and expenditures for labor, fertilizer, and feed, 1919.

The rural population, which includes all persons living outside of incorporated places having 2,500 inhabitants or over, was 51,406,017 in 1920, as compared with 49,806,146 in 1910. The number of farms was 6,448,343, as compared with 6,361,502 in 1910. Total area of land in farms in 1920 was 955,883,715 acres, as compared with 878,798,325 acres in 1910. The improved land in farms amounted to 503,073,007, or an increase of 5.1 per cent. The value of all farm property in 1920 was \$77,924,100,338. Of the total number of farms in the United States in 1920, 12.4 per cent were under 20 acres in size, 23.3 per cent contained from 20 to 49 acres, 22.9 per cent from 50 to 99 acres, 22.5 per cent from 100 to 174 acres, 15.6 per cent from 175 to 499 acres, 2.3 per cent from 500 to 999 acres, and 1 per cent 1,000 acres and over.

Farm vegetables ([U. S.] *Bur. of the Census, 14. Census, Agr., 1922, pp. 76*).—This publication presents figures for the year 1919 taken in the 1920 census. A brief section is devoted to potatoes, another to sweet potatoes, a third to the farm garden, and the fourth to miscellaneous vegetables classified as truck crops and distinguished from farm or field crops. The total number of farms which forms the base for the percentages given in connection with the number of farms reporting is shown by divisions and States. The statistics are presented for the United States as a whole by geographic divisions, by States, and by counties.

Farm animals ([U. S.] *Bur. of the Census, 14. Census, Agr., 1922, pp. 98*).—Statistics from the 1920 census are presented which indicate the extent to which cattle, swine, and chickens are raised on farms in the United States, giving farms reporting, number on hand, and farms not reporting, 1920; and calves, pigs, and chickens raised and eggs produced, 1919. Comparative figures from the censuses of 1920 and 1910 are presented in so far as the data are available.

AGRICULTURAL EDUCATION.

Desirable future developments in rural education, K. L. BUTTERFIELD (*Jour. Rural Ed., 2 (1922), No. 2-3, pp. 49-51*).—Some fundamental ideals and principles of education for democracy are listed, as well as some practical suggestions to administrators of rural school systems.

Curriculum building for vocational agricultural education in secondary schools, J. L. HYPES (*Jour. Rural Ed., 2 (1922), No. 2-3, pp. 88-101*).—It is held that the content and arrangement of the course of study, as well as the methods of teaching, should meet the needs of society, the requirements of the vocations, and the interests and capacities of the students.

A program of studies for a boys' rural high school is offered as a tentative step in the organization and adaptation of programs of study for fairly large high schools and for the average high school student who will remain until graduation.

Summary of the winter short-term agricultural work in Iowa, W. H. BENDER (*Vocat. Ed. Mag., 1 (1923), No. 5, pp. 344-346*).—The plan of organization and administration, working conditions to be faced in starting and developing the plan, and work under way are outlined here.

Short courses: Their place and function in a program in agricultural education, H. O. SAMPSON (*Vocat. Ed. Mag., 1 (1923), No. 5, pp. 337-339*).—

A brief account is given of the short course schools of agriculture held in New Jersey in 1921 by county vocational school and high school men with farm boys and men.

Developments in home economics teacher training in California, M. I. MURCHIE (*Vocat. Ed. Mag.*, 1 (1923), No. 5, pp. 366-368).—A brief review of teacher-training courses in home economics offered in various institutions of the State and three types of technically trained teachers are described.

Suggestions for improving the training of teachers and supervisors of home economics, C. M. WINCHELL (*Vocat. Ed. Mag.*, 1 (1923), No. 5, pp. 360-366).—Excerpts are given from replies to a letter sent out from Teachers College, Columbia University, in August, 1922, requesting suggestions along this line. They fall into the four groups of the need for more professional training, greater provision for liberal education, sufficient home-making training and experience to render the teacher versatile both in her conception of the vocation of home making and in her housekeeping practice, and improvement in her professional attitude.

An annotated list of official publications on consolidation of schools and transportation of pupils, compiled by J. F. ABEL (*U. S. Bur. Ed., Rural School Leaflet* 9 (1923), pp. 12).—This list includes publications issued up to September, 1922. They are listed by States and as U. S. Department of Agriculture and U. S. Bureau of Education publications.

Handicaps of the rural child, O. G. BRIM (*Jour. Rural Ed.*, 2 (1922), No. 2-3, pp. 52-63).—This paper, read before the American Country Life Association in November, 1922, considers the provisions for formal rural schooling in the United States, but attempts mainly to evaluate the educational forces in rural life and the environment outside of the school. The question is raised as to the advisability of consolidation of schools in the open country and the further distinction between rural and urban groups with its consequent development of group mindedness.

Americanization through the rural school, A. DRURY (*Jour. Rural Ed.*, 2 (1922), No. 2-3, pp. 69-73).—The program of a particular school is described.

Education of adult illiterates, M. McLEES (*Jour. Rural Ed.*, 2 (1922), No. 2-3, pp. 73-78).—The story of adult education in a rural county of South Carolina by means of moonlight and "lay-by schools" and at a vacation school at Tamasee, S. C., in August, 1921, is related here.

Principles and achievements in adult education under the Smith-Lever Act, C. B. SMITH (*Jour. Rural Ed.*, 2 (1922), No. 2-3, pp. 78-88).—The trend of development of extension teaching as it affects adults is presented here. The way in which a community program may be developed is described.

MISCELLANEOUS.

Annual Report of California Station, 1922, C. M. HARING (*California Sta. Rpt.* 1922, pp. 15-214, pl. 1, figs. 61).—This contains a report of the director, together with a summary of the results of investigations during the year. Lists of the various station projects and publications of the year are appended. The experimental work reported is for the most part abstracted elsewhere in this issue.

One hundred worth-while accomplishments of the college of agriculture the past two years (*Nebraska Sta. Circ.* 18 (1922), pp. 12).—Brief statements are given regarding 100 recent specific accomplishments of the college of agriculture and the station.

NOTES.

California University and Station.—C. F. Shaw, professor of soil technology, left Berkeley February 8 on five months' sabbatical leave to be spent in visiting various regions of the Pacific. It is expected that six weeks will be spent in the Hawaiian Islands, two weeks in New Zealand, and two or more months in Australia, with brief stops in the Fiji Islands, Tahiti, and the Society Islands. The purpose of the trip is the study of the soil conditions in the three major regions to be visited.

Elwood Mead, professor of rural institutions, has been granted sabbatical leave for six months, beginning April 15, to be spent in Australia, Java, India, and Italy, and possibly the Philippine Islands, in a study of the development of irrigated land in these countries, and especially in Australia of the progress in land settlement during the past seven years.

H. J. Quayle, professor of entomology in the Citrus Experiment Station and Graduate School of Tropical Agriculture, has been granted sabbatical leave beginning March 1 for a period of six to twelve months. Mr. Quayle is to go to Australia, where he will study the question of fumigation, assist in instructing growers in fumigation methods, and conduct trials of materials in continuation of experiments begun in California, securing advance data on the problem before the next fumigating season.

Connecticut State Station.—Samuel T. Sealy, deputy in charge of mosquito elimination, has resigned, effective April 1.

Georgia Station.—Max L. McRae of McRae and Nesbit Harper of Lithia Springs have been appointed as members of the board of directors vice F. R. Mann, deceased, and J. T. Duncan.

Michigan Station.—The establishment of experimental plats for soil-building purposes in about 40 counties has been authorized. These plats will comprise about 50 acres in each county, and will contain from 5 to 10 acres each of cut-over and worn-out land to be sown to sweet clover, alfalfa, and other grass seeds.

New Hampshire College and Station.—Under a plan of exchange professorships, G. F. Potter, professor of horticulture and horticulturist, has given a seminar course for a week at the Massachusetts College, while Dr. J. K. Shaw, research professor of pomology in the Massachusetts Station, will later give a return series of daily talks and discussions.

Pennsylvania College.—The resignations are noted of J. M. McKee, associate professor of rural economics extension, effective February 1; J. R. Dawson, assistant professor of dairy husbandry extension, and P. L. Koenig, assistant in agricultural extension, effective March 1; and P. L. Sanford, assistant professor of poultry husbandry extension, effective April 1.

South Dakota College and Station.—The legislature has appropriated \$20,000 per annum for specific experiments in horticulture and live stock.

President W. E. Johnson has resigned to take effect July 1. C. Larsen, who has been on leave of absence and connected with the Illinois Agricultural Association for the past two years, returned January 1 as dean of agriculture.

Washington Station.—The station has established a cranberry laboratory at Ilwaco for the study of cranberry diseases. D. J. Crowley is in charge of the investigations.

EXPERIMENT STATION RECORD.

VOL. 48.

MAY, 1923.

No. 7.

The economic utilization of the nonarable land in this country is a matter of great importance, and one for which success depends in no small degree on the results of scientific investigation. Particularly is this true of the vast areas which in the light of present knowledge seem best adapted to grazing. These areas present many specialized and distinctive problems, some of which endanger the permanence, limit the success, and determine the profits of the system under which the range is managed. Some of these problems have received for many years the active attention of the experiment stations in the range States, and while much remains to be done, the industry has benefited greatly by what these institutions have already accomplished.

Historically, ranching, as farming under range conditions is usually termed, has been mainly a frontier industry, primitive in type, exploitive in purpose, and commonly regarded as a mere transition stage destined inevitably to give way to the more intensive methods of crop production. Ranching under modern conditions, however, is something quite different. It is a creative, productive industry, utilizing very largely land unsuited to other types of farming, and constituting a factor to be reckoned with and provided for as a permanent phase of American agriculture.

The huge extent of the land in this country which, because of deficiencies in moisture, topography, soils, accessibility, or other conditions, will in all probability never be brought under the plow is not always realized. According to a recent estimate, there were in 1910 about 745 million acres of range land and unimproved pasture, or nearly 40 per cent of our total land area. Some of this will ultimately be available for cultivation, but it is also estimated that at least two-thirds of the present forests and woodlands are suitable for grazing. Readjustment on this basis indicates a probable area of no less than 855 million acres as potential permanent grazing land. This would comprise at least 45 per cent of the total land area, an amount almost equal to that regarded as potentially utilizable as improved land in farms.

Large as are these areas, however, the time when they were in excess of the demands upon them has long since passed away. With

the realization of their limited extent and resources has come a change from the original policy of exploitation to one of economic development. This is, of course, somewhat analogous to what has happened as regards arable land and what is becoming more and more recognized as necessary in forestry. The new conception involves a study of the resources of the range and means for their conservation, a testing of methods of animal husbandry under range conditions, a better knowledge of animal diseases, poisonous plants, and other enemies of live stock, and not least in importance a consideration of the economic and social relationships of the people on the range. All of these phases are matters of legitimate concern to the experiment stations and other research agencies, and it is reasonable to expect that increasing attention will be devoted to them, particularly in those States wherein ranching has played and probably will continue to play a leading agricultural rôle.

Many of the stations in the past, limited in resources and charged with the responsibility of assisting in developing from pioneer conditions a permanent agricultural industry as rapidly as possible, have very naturally directed their efforts primarily to the solution of problems of the farm rather than those of the range. None the less, the interests of the latter have been by no means neglected, as may be demonstrated by the brief summary of their work which follows.

Apart from observations on the vegetation of the range, the effects of exploitation, and the general conditions of range practice, diseases peculiar to stock under range management early claimed the attention of the stations, and this was followed by studies of poisonous plants, which have taken such a heavy toll at times. Equally important has been the work on the improvement of the grade of range stock, upon which much has been done by several of the stations, and on its more advantageous management. More recently the value of various range plants as emergency feeds, the supplementing of the range by crops grown for the purpose, the place of the silo in range farming, the wintering and handling of breeding stock, the improvement of wool, including the effect of range conditions on quality, and many other aspects of range farming have been given careful study.

Several of the stations have featured range studies prominently. This has been true of the Arizona Station, whose studies date almost from its establishment; the New Mexico Station, which has led the other stations in the study of the nutritive value and feeding of range plants; and the Wyoming Station, which has made the study of poisonous plants a prominent feature of its work for many years. In 1916 the Texas Station established a range station near Sonora in the western part of the State on a tract of 3,200 acres of land, inclosed in a substantial wolf-proof fence, and well equipped with

buildings for its special work. Since 1919, the same station has also maintained a division of farm and ranch economics, which, among other things, has given attention to the economic phases of ranch and range management. The Nevada Station established a department of range management in 1915, and has since centered practically its entire activities on questions relating to range agriculture. Several other stations have organized departments of range management or made special provision for studying range problems.

One of the earliest phases of the ranching problem to be investigated was that of range vegetation. Studies have been reported on a large number of range plants, their distribution, abundance, relative value, growth and seed habits, natural renewal, persistence under pasturing, encroachment of new forage plants and weeds, and methods of reproduction by most of the western stations. About forty publications have been issued dealing with this subject, representing some thirteen stations, and active projects are now in operation at eleven stations. These projects deal for the most part with problems of revegetation of natural ranges, the effect of grazing on native species, and the value of cacti and other range plants for forage purposes.

Several stations have made studies of the composition, digestibility, and nutritive value of the leading forage and emergency plants of the ranges. Feeding experiments with range plants have been conducted by several stations. Several of these have been with soapweed (*Yucca elata*). The Arizona Station has found this material to be a good emergency ration, and the New Mexico Station has corroborated this finding, especially when the soapweed stems are supplemented by a small quantity of a high protein feed such as cottonseed meal. No injurious effects were noted from the use of either of these materials. Chamiza has also been found of value as a range supplement or emergency feed for short periods, though its long-continued use apparently brings unfavorable complications. The question of silage crops to supplement the range in periods of drought and in winter has been taken up. Corn and sorghum silages have been found satisfactory for this purpose in Arizona, while in New Mexico some encouraging results have been obtained with Russian thistle. Various hays, including Russian thistle hay, wheat straw, tornillo, mesquite, and pinto beans are among the other supplements which have been investigated.

The restoration of depleted range areas has been a favorite topic of inquiry. An important finding was announced by the Arizona Station, working in cooperation with the U. S. Department of Agriculture, to the effect that eleven years' observations have indicated that seriously depleted ranges recovered faster when pastured

judiciously with approximately all the cattle they would carry than when not grazed at all.

The grazing capacity of ranges for various classes of live stock has been tested in Arizona, Nevada, Nebraska, New Mexico, North Dakota, Texas, and Washington. Great variation has been found with different species of plants and different kinds of animals, and valuable information acquired as to safe limits of grazing. In Nevada, a comparison of the method of establishment of a new bed ground for sheep each night with the usual practice of returning the flock to an established camp indicated that the one-night camp system increased the carrying capacity of the range over 20 per cent, improved the milk production of the ewes, and resulted in more rapid gains in the lambs. Attention has also been given by several stations to the distribution of stock watering places in its relation to the benefits to both the stock and the range, to range management methods leading to the destruction of poisonous plants, and to the advantages of deferred and rotational grazing. In some States, these studies have formed the basis of suggestions and recommendations for rational range management and the control of public grazing lands.

In view of the heavy losses of stock on the range from poisonous plants, the early attention given to this problem is not surprising. The Montana Station was among the first to take up the question, some of its studies dating back to the early nineties. Considerable work has also been reported from Nevada and Wyoming, and more recently from Arizona and Colorado. A large number of supposedly poisonous plants have been examined, affording detailed information of great value. In many cases the toxic principles have been isolated, and with others data have been obtained showing how their relative toxicity varies with the time of year and maturity, while others seem toxic under all conditions. Overstocking of the range and exhaustion of other forage has been shown to be a frequent cause of disastrous losses, the range management specialist of the Nevada Station estimating an annual loss in that State alone of \$1,000,000 from poisonous plants consumed under these conditions. Death camas, one of the most dangerous of the group, has been shown to be most likely to prove a serious menace when hungry stock is turned out on ranges where there is very little grass or other palatable feed. Such findings, even when in accordance with general observation, are none the less of much value in minimizing losses.

The diseases of range stock have been the subject of numerous specific investigations. Studies have been made in Nevada and California of a hemorrhagic disease of cattle which recently has been named ictero-hemoglobinuria in cattle. Bovine redwater, goiter, a

so-called "lunger" disease of sheep in Montana, tuberculosis under range conditions, and swamp fever or infectious anemia of horses are among other diseases to which special attention has been given. In the last-named disease, the instrumentality of certain biting flies seems to have been established. A muscle parasite (*Sarcocystis tenella*) has been studied by the Wyoming Station, the results pointing to a theory of an infective intestinal stage, and with control measures suggested based on a theory of infection from food contaminated with infective feces.

The economic aspects of ranching have been considered to a greater or lesser extent in the studies of range management already referred to. Of special interest from this point of view, however, is an elaborate economic study recently issued by the Texas Station of a typical ranching area in that State. This study is announced by the authors as "undertaken in part to correct the impression that ranching is essentially an exploitive industry and that it is destined to pass away, and in part to aid in placing the grazing industry on a sound economic and social basis." In this bulletin of over four hundred pages, a somewhat detailed analysis has been made of the various phases of ranching in the areas studied, with a view to calling attention to the more pressing economic problems, and where the data will warrant to suggest remedies for the existing ills of ranching. The survey is noteworthy not only for its comprehensiveness as an economic study of the industry, but also for the large place within its pages assigned to social studies of the ranch community and ranch life and the stability of the ranch population. Although dealing with only a restricted area, it seems quite likely that the authors' expressed hope that the work may "lead to similar studies more profound and extensive in character" may find ultimate realization.

No attempt has been made in the foregoing discussion to review either systematically or completely the work of the stations pertaining to farming under range conditions. The thought has been merely to refer very briefly to some of the lines along which these institutions have been working, and to some of the more outstanding results thus far secured. This has been done to demonstrate that the stations have already made a notable contribution to the subject, and also that the field of inquiry has been by no means exhausted.

One conclusion seems to have been quite definitely established, namely, that range utilization is a highly specialized problem, and that much more than a simple adaptation of findings derived in studies of other types of agriculture will be necessary for its solution. So far as crop production is concerned, the lands which seem destined

to remain uncultivated are almost entirely submarginal, and even when utilized to the fullest extent as ranches their productivity per acre is both relatively and absolutely low. This means a much larger sized economic unit than in ordinary farming, specialized systems of land tenure, credit, and taxation, large-scale operations and a distinctive system of management, and other materially different biological, economic, and social factors. These factors influence investigation to an extent not always fully comprehended, and make the first requisite in an attack a thorough survey and visualization of the field.

A second requisite is a realization of the complexity of the problem. As in studies of crop production, though not necessarily in the same relative proportions, the services of botany, chemistry, and meteorology, the principles of animal feeding and breeding, veterinary medicine, entomology, engineering, and to a notable degree economic and sociology will all be needed. A specialist in range management, then, while most helpful as a nucleus and as a means of focusing attention on the problem as a whole, should no more be expected to solve the many questions of the range single-handed than a one-man staff the other agricultural problems of a State. As a matter of fact, the opportunities for cooperation of departments within an institution or of institutions throughout a region seem particularly promising in this direction.

The criticism has sometimes been made that the agricultural colleges of the West, especially those of the more strictly grazing sections, have thus far paid hardly enough attention to such subjects as range animal husbandry and ranch economics. Doubtless so far as this criticism may be warranted, the difficulty has been mainly the shortage of funds on the part of these institutions, and therefore will tend to be rectified as their resources become more ample. In view of the large place which the range seems destined to retain as a contributor to the American food supply and as the workshop and abiding place of many thousands of our rural population, it would seem that its interests are entitled, in the fullest degree available, to systematic and substantial consideration from all who are concerned with the upbuilding and development of the agricultural industry.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Proceedings of the thirty-seventh annual convention of the Association of Official Agricultural Chemists, 1921 (*Jour. Assoc. Off. Agr. Chem.*, 5 (1922), Nos. 3, pp. 352-437, figs. 3; 4, pp. 439-599, figs. 9; 6 (1922), Nos. 1, pp. 112, figs. 3; 2, pp. 113-208, figs. 4).—This is the complete report of the convention held at Washington, D. C., October 24-26, 1921. Abstracts of some of the papers presented are given on pages 609 and 611.

The chemical composition of soy bean oil, W. F. BAUGHMAN and G. S. JAMIESON (*Jour. Amer. Chem. Soc.*, 44 (1922), No. 12, pp. 2947-2952).—The following data are contributed from the Bureau of Chemistry, U. S. D. A., on the physical and chemical characteristics and composition of the oil obtained from the Mammoth Yellow variety of soy bean by means of an oil expeller. The physical and chemical characteristics are specific gravity 25°/25° 0.9203, refractive index 20° 1.4736, iodine number (Hanus) 128.0, saponification value 189.5, acid value 0.5, acetyl value 17.0, Reichert-Meissl number 0.16, Polenske number 0.26, unsaponifiable matter 0.6 per cent, saturated acids (determined) 12.7, unsaturated acids plus unsaponifiable matter (determined) 83.0, saturated acids (corrected) 11.5, and unsaturated acids (corrected) 83.5 per cent, iodine number of unsaturated acids 148.7, and α -iodine number 14.5.

The composition of the oil as glycerids of fatty acids is as follows: Linolenic 2.3 per cent, linolic 51.5, oleic 33.4, palmitic 6.8, stearic 4.4, arachidic 0.7, lignoceric 0.1, and unsaponifiable matter 0.6 per cent.

The chemical composition of sunflower-seed oil, G. S. JAMIESON and W. F. BAUGHMAN (*Jour. Amer. Chem. Soc.*, 44 (1922), No. 12, pp. 2952-2957).—Similar data are given on the composition of sunflower-seed oil pressed from seed grown in southeastern Missouri. The oil is said to have a pale yellow color, a mild taste, and a pleasant odor, and to dry somewhat more slowly than soy-bean oil. The physical and chemical characteristics are as follows: Specific gravity, 25°/25° 0.9193; refractive index, 20° 1.4736; acid value, 2.3; iodine number (Hanus), 130.8; acetyl value, 14.5; saponification value, 188.0; Reichert-Meissl number, 0.27; Polenske number, 0.25; unsaponifiable matter, 1.20 per cent; iodine number of unsaponifiable matter, 124.8; saturated acids (determined), 7.4 per cent; iodine number of saturated acid fraction, 5.0; unsaturated acids plus unsaponifiable matter (determined), 87.5 per cent; iodine number of unsaturated acids plus unsaponifiable matter, 147.5; iodine number of unsaturated acids, 147.9; saturated acids (corrected), 7.1 per cent; and unsaturated acids (corrected), 36.6 per cent.

The proportion of glycerids of the fatty acids is as follows: Oleic, 33.4 per cent; linolic, 57.5; palmitic, 3.5; stearic, 2.9; arachidic, 0.6; lignoceric, 0.4; and unsaponifiable matter, 1.2 per cent.

The odorous constituents of apples.—II, Evidence of the presence of geraniol, F. B. POWER and V. K. CHESNUT (*Jour. Amer. Chem. Soc.*, 44 (1922), No. 12, pp. 2938-2942).—From the parings of McIntosh apples the authors have

obtained, in addition to the amyl esters previously isolated from several varieties of apples (E. S. R., 43, p. 711), the aliphatic terpene alcohol geraniol, $C_{15}H_{25}O$. The peculiar rose-like fragrance of the McIntosh and probably of other fragrant varieties of apples is attributed to this substance, which occurs in the free state or as an ester.

Confirmation of the occurrence of linalyl esters in peaches, F. B. POWER and V. K. CHESNUT (*Jour. Amer. Chem. Soc.*, 44 (1922), No. 12, pp. 2966, 2967).—Further evidence is presented that the odorous constituents of the peach consist chiefly of an ester of the aliphatic terpene alcohol linalool, $C_{10}H_{18}O$, isomeric with geraniol as previously noted (E. S. R., 46, p. 202).

Influence of lysin upon the hydrolysis of starch by purified pancreatic amylase, H. C. SHERMAN and M. L. CALDWELL (*Jour. Amer. Chem. Soc.*, 44 (1922), No. 12, pp. 2926-2930).—In continuation of the investigation of the effect of different amino acids on the hydrolysis of starch by pancreatic amylase (E. S. R., 46, p. 708), a similar study has been made of lysin.

Contrary to the results obtained with the other amino acids studied, lysin showed no activation of the amylolytic but a favorable influence on the saccharogenic action. These results are interpreted as follows:

"According to the view that the enzyme (pancreatic amylase) is essentially a protein substance which gradually becomes inactivated through hydrolysis in the aqueous medium in which it acts, and that the apparent 'activating' influence of amino acids is due to retardation of this hydrolysis of the enzyme. It appears probable that the lysin in the enzyme molecule is so bound that it would not in any case be split off until after the stage of amylolytic action had been passed, but that it (lysin) is concerned in the later stages represented by saccharogenic activity and, therefore, the addition of lysin to the enzyme solution tends to conserve the enzyme by diminishing the rate of its further hydrolysis at this later stage."

Influence of amino acid in protecting amylase from inactivation by mercury, H. C. SHERMAN and M. L. CALDWELL (*Jour. Amer. Chem. Soc.*, 44 (1922), No. 12, pp. 2923-2926).—Following a suggestion that the difference in behavior of histidin and tryptophan from other amino acids toward the amylolytic action of purified pancreatic amylase (E. S. R., 46, p. 708) might be due to the presence of traces of mercury accidentally remaining in these two amino acids after their purification, the authors have tested the effects of the addition of small amounts of mercury upon the amylolytic and saccharogenic action of purified pancreatic amylase in the presence and absence of two amino acids, glycine and phenylalanine.

It was found that while the mercury, even in concentrations as low as 0.000003 M mercuric chlorid, inactivated to a marked extent the action of amylase, this inactivation was prevented and the activity of the amylase increased by the addition of from 50 to 100 mg. of the amino acid per 100 cc. of the solution. These results are thought to indicate that such minute amounts of mercury as might have been present in the histidin and tryptophan preparations used could not account for their entire lack of activating influence upon the amylolytic action of the enzyme, and also to show that amino acids protect against small concentrations of mercuric chlorid when testing the activity of purified pancreatic amylase.

Protein storage in protoplasmic tissue, C. R. MOULTON, W. S. RITCHIE, and E. G. SIEVEKING (*Missouri Sta. Bul.* 197 (1922), p. 34).—From determinations by the Van Slyke method of the nitrogen distribution in 15 samples of fairly pure beef globulin-albumin, the following results are reported: Humin nitrogen from 2 to 4 per cent, arginine from 12.3 to 14.8, cystine from 2 to 3, histidine from 2.7 to 10, lysine from 12 to 15, and total monamino acids from 51 to 61 per cent

of the total nitrogen. It is noted that an emaciated animal showed a low cystin, arginin, and lysin content and a high histidin content.

Some experiences with the alkaline permanganate method, C. S. ROBINSON and O. B. WINTER (*Jour. Assoc. Off. Agr. Chem.*, 5 (1922), No. 4, pp. 446-450, fig. 1).—The authors discuss the chemical changes involved and the sources of error in the Official alkaline permanganate method for the measurement of the quality of the organic nitrogen in fertilizers, and report unsuccessful attempts to overcome the defects of the method by modifying the size of the sample and the time of distillation. It is concluded that "any new method must be built upon an entirely new foundation for which more fundamental chemical knowledge of the factors involved in availability is necessary, and that it is highly desirable that more systematic vegetation experiments be carried on, thus giving more reliable standards upon which to base conclusions regarding the values of any methods proposed."

The determination of extremely small amounts of phosphorus by the Official method, R. C. WILEY (*Jour. Assoc. Off. Agr. Chem.*, 5 (1922), No. 4, pp. 465, 466).—A modification of the Official volumetric method for phosphorus, by means of which it is stated that as small an amount as 0.01 mg. of phosphorus can be detected, is described as follows:

"Measure an aliquot of the solution into a beaker and add 20 cc. of a saturated solution of ammonium nitrate and enough water to make the total volume about 75 cc. Heat the solution to 55° C. in a water bath and add ammonium molybdate solution of the same temperature. After 15 minutes filter off the precipitate and carefully wash free from acid with distilled water. Carefully transfer the precipitate and paper into the beaker and dissolve in N/50 sodium hydroxid. Add phenolphthalein. Neutralize the solution with N/100 sulphuric acid, and from the difference in readings calculate the amount of phosphorus."

The determination of small amounts of potash by the Lindo-Gladding method, W. HAZEN (*Jour. Assoc. Off. Agr. Chem.*, 5 (1922), No. 4, pp. 456-460).—Following the suggestion of Moore and Caldwell (*E. S. R.*, 44, p. 803) that the low results obtained by them in the determination of small amounts of potash by the Lindo-Gladding method, using 80 per cent alcohol, are due to the presence of sodium salts, analyses were made of samples of potash associated with varying amounts of sodium sulphate and sodium chlorid. Each set was divided into two groups, in one of which 80 per cent and in the other 95 per cent alcohol was used for the removal of the excess platinic chlorid, while for the final washing 80 per cent alcohol was used in both cases.

The values obtained confirmed those of Moore and Caldwell that low results are obtained with 80 per cent alcohol, but did not confirm their theory that this was due to the sodium salts, as these were found not to alter the results. The theory advanced by the authors and apparently confirmed by the experimental data reported is that the 80 per cent alcohol exerts a solvent action on the potash precipitate. Trials with 90 per cent alcohol in place of 95 per cent indicated that it can be substituted with safety for the 95 per cent and has the advantage that fewer washings are required to free the precipitate from ammonium chlorid and foreign matter. If small amounts of potash are involved and high accuracy is desired, the use of 90 per cent alcohol is recommended both before and after ammonium chlorid treatment, but in ordinary work it is recommended that 90 per cent alcohol be used in the initial and 80 per cent in the final treatment.

A rapid method of analysis for dolomite and magnesian limestone, S. D. AVERITT (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 12, pp. 1139, 1140).—

This contribution from the Kentucky Experiment Station consists of a description of an indirect method for determining calcium carbonate and magnesium carbonate in dolomite and magnesian limestone. The method involves the determination of the neutralizing power of the material as calcium carbonate, insoluble residue and ammonium precipitate, and moisture. The technique for each determination and the derivation of the formulas required are discussed in detail.

Note on a colorimetric method for the determination of small amounts of magnesium, F. S. HAMMETT and E. T. ADAMS (*Jour. Biol. Chem.*, 54 (1922), No. 3, pp. 565, 566).—On the discovery that the best acid-washed asbestos contains sufficient phosphorus or other substances giving the Bell-Dolsy color reaction to yield a positive color test, the authors have modified their recently described method of determining magnesium (E. S. R., 47, p. 804) by centrifuging instead of filtering the precipitated NH_4MgPO_4 .

Methods of determining the number of microorganisms in tomato products, C. A. DARLING (*New York State Sta. Tech. Bul.* 91 (1922), pp. 5-56).—The investigation reported in this publication was undertaken under the auspices of the National Research Council to ascertain the reliability of the liquid-mount Howard (E. S. R., 38, p. 166) and other methods for examining tomato products for bacterial contamination of the original material.

The procedure followed was to prepare pulp from tomatoes containing known amounts of decay (30 samples being used), and to determine the number of microorganisms present in the fresh pulp by the plate culture, the dried-and-stained smear, and the Howard methods. After this examination the pulp was sterilized by heating in a stoppered flask for one hour in running steam, and after several weeks was reexamined by the dried-and-stained smear and Howard methods. The pulp was then concentrated and made into catsup which was later examined by the two methods used for the processed pulp. In addition to the estimation of the total number of microorganisms, estimates were made of the amount of mold, the number of yeast cells and mold spores, and the number of rod-shaped bacteria in the different samples.

After this work was completed broth cultures of *Bacillus subtilis* and *Bacterium coli*, respectively, were added in definite proportions to each of the three samples of fresh pulp. The pulp was subsequently examined before and after sterilization and concentration for the number and relative proportions of these bacteria.

The results of the various analyses indicate that, because of the heterogeneous character of the sample, very large errors are bound to occur in the estimates of the number of microorganisms, regardless of the methods employed. Duplicate counts of rod-shaped bacteria from the fresh sample showed wide discrepancies, which appeared to be due largely to the difficulty of distinguishing between bacteria and cell debris in the unstained material. The counts from uninoculated samples made from dried-and-stained mounts were much larger in the case of the fresh than of the processed and still larger than of the concentrated material. This effect is considered to be due to destruction or loss of staining power of the bacteria in processed material.

The counts made by the liquid-mount method of Howard showed a variable but marked increase in the number of fragments of mold hyphae, yeasts, spores, and bacteria per unit volume with increase in concentration. The number of microorganisms in a given sample was found to bear no close relationship to the amount of decay in the original stock. While the count was in excess of the U. S. Department of Agriculture standards in all materials containing more than from 4 to 7 per cent of decayed stock, it proved impos-

sible to tell the relative amount of decayed material present. Some samples known to contain only a small amount of unfit material gave a count of mold hyphae more than twice that in samples known to contain as much as 44 per cent of decayed stock.

In discussing and interpreting the results obtained consideration is also given to the various objections, with substantiating data, which have been raised against the Howard method from time to time. The conclusion is finally drawn that the character of tomato products does not lend itself to the tests ordinarily applied in determining the number of microorganisms in a given food, and that consequently neither the Howard nor the other two methods used can be relied upon for this purpose. Two methods of control are suggested, (1) the improvement of the liquid-mount method for use on the processed material, or (2) the establishment of a control over the quality of the product as made. Suggestions along the first line are "that every effort be made to secure a uniform and well-mixed portion for microscopic examination, that the present system of recording the percentage of fields showing mold hyphae be changed to one showing the number of hyphal fragments per unit volume, that the magnification used in making the yeast and spore count be the same as that used in making the bacterial counts, and that the amount of material examined in cases where the accuracy of results is of great importance be made much larger than is specified at present."

Of still greater value is thought to be factory inspection at the time the catsup is made, supplemented by a laboratory inspection of the fresh pulp, preferably from dried-and-stained mounts.

The moisture content of dried milk, G. E. HOLM (*Jour. Assoc. Off. Agr. Chem.* 5 (1922), No. 4, pp. 509-511).—Attention is called to the hygroscopic nature of milk powders, particularly those manufactured at temperatures not sufficiently high to destroy the colloidal properties of the milk. The moisture content of milk powders can best be determined by drying them under partial vacuum at a temperature of 100° C. for one hour. "To insure absolutely reliable results in control methods or in any work upon this product, it is necessary to safeguard the products by shipping them in tightly sealed glass or metal containers, since changes in the moisture content mean heterogeneous and unreliable results with regard to other determinations, such as fats, proteins, etc."

Modified procedure for the determination of the turbidity point of butter fat, A. SEIDENBERG (*Jour. Assoc. Off. Agr. Chem.*, 5 (1922), No. 4, pp. 512, 513).—With the exception of a few minor changes in technique, the method described is essentially the same as that previously noted (E. S. R., 39, p. 715).

A method for the quantitative determination of trypsin and pepsin, J. H. NORTHROP and R. G. HUSSEY (*Jour. Gen. Physiol.*, 5 (1923), No. 3, pp. 353-358, fig. 1).—The method described is based upon the observation that with other factors properly controlled, including temperature and H-ion concentration, the time required to cause a given percentage change in the viscosity of a purified gelatin solution containing pepsin or trypsin is nearly inversely proportional to the amount of enzyme present. "It is pointed out that the particular value of the method lies in the fact that enzyme reactions which take place in the presence of 'buffer' salts may be studied."

Further experiments on the isolation of the antineuritic vitamin, A. SEIDELL (*Jour. Amer. Chem. Soc.*, 44 (1922), No. 9, pp. 2042-2051).—The technique for the preparation of an active vitamin fraction from yeast described in this paper differs from that previously noted (E. S. R., 46, p. 864) chiefly in that the vitamin-activated fuller's earth is prepared by the improved method previously noted (E. S. R., 47, p. 408) instead of from autolyzed yeast.

The distribution of the active vitamin in the several fractions obtained has been studied by the physiological method previously described (E. S. R., 48, p. 12). In this work the unit of active vitamin is defined as that quantity of vitamin which, given a normal pigeon on each alternate day, is just sufficient to replace the vitamin deficiency of an exclusive diet of polished rice. As determined in this way, the minimum protective dose of the solids and the calculated units of vitamin present in the various fractions obtained from a given amount of the activated solid are, respectively, as follows: Original dried vitamin extract 7.5 mg. and 1,295, silver nitrate precipitate 5 mg. and 551, ammoniacal silver nitrate precipitate 3 mg. and 197, and the fraction non-precipitable by silver 15 mg. and 424.

The various fractions obtained by silver precipitation have been found to be quite stable, both in solution and in the dried state if, before drying, the silver is removed by hydrochloric acid or hydrogen sulphid. The vitamin and other bases present in the extract dialyze almost completely through a colloid membrane, thus indicating a relatively simple constitution of the vitamin molecule.

A comparison of the nitrogen content of the various fractions with their activity showed that in the ammoniacal silver nitrate a smaller amount of nitrogen was present than in the other fractions, thus indicating that a considerable proportion of the nitrogen in some of the fractions must represent other bases than vitamin. These bases can not be separated completely by silver precipitation. It is concluded that the complex character of all the vitamin fractions thus far obtained accounts for the exceptional difficulty encountered in all efforts to identify the active substance.

A new British saccharimeter, L. BELLINGHAM and F. STANLEY (*Internatl. Sugar Jour.*, 24 (1922), No. 287, pp. 587-590, figs. 3).—Some of the well-known defects in the present type of saccharimeter are listed and discussed, and a new type of polariscope, designed particularly to overcome these defects, is described and illustrated.

A study of the factors affecting the jellying of fruits, L. W. TARR (*Delaware Sta. Bul.* 133 (1922), pp. 14, 15).—The present report is confined to the results of a quantitative study of the function of acid in the formation of jells.

With a sugar-pectin ratio of 62.5 gm. : 1 gm., the amounts of sulphuric, phosphoric, tartaric, citric, and acetic acids required barely to form a jell and to make the optimum jell were determined. The results expressed as grams of acid required per 100 gm. of juice are, respectively, as follows: Sulphuric, 0.0295 and 0.032 gm.; phosphoric, 0.045 and 0.0525; tartaric, 0.065 and 0.2000; citric, 0.185 and 0.2000; and acetic acid, 1.75 and 2.000 gm.

These varying concentrations of the different acids represent a practically constant H-ion concentration at approximately pH 3.4 at the least jellying point and at pH 3.1 at the optimum point. Further confirmation of the significance of the H-ion concentration in jellying was afforded in attempts to prepare jelly from juices differing only in H-ion concentration at definite intervals of 1 pH from pH 2 to pH 10. It was found that at pH 3 and below excellent jellies could be made, while at pH 4 and above it was impossible to make a jell. A comparison of the dissociation constants of the various acids used in the experimental work also showed that the quantity of acid required varied directly with the strength as indicated by the dissociation constant.

Modern glues and glue handling, C. H. TEESDALE and C. M. BEZEAU (*Grand Rapids, Mich.: Periodical Pub. Co.*, 1922, pp. 192, figs. 24).—This volume consists of two parts. Book I, on modern glues and glue testing, contains general information on the manufacture and use of glue, with an appendix on the methods of testing animal glue in use at the U. S. Forest Products Laboratory,

Madison, Wis. Book II, on glue-room equipment and the use of glue, contains a general discussion of glue-room practices, with suggestions for successful glue salesmanship.

METEOROLOGY.

Weather prediction by numerical process, L. F. RICHARDSON ([London]: Cambridge Univ. Press, 1922, pp. XII+236, figs. 7; *rev. in Nature* [London], 110 (1922), No. 2771, pp. 762-765).—This book presents "a scheme of weather prediction which resembles the process by which the Nautical Almanac is produced, in so far as it is founded upon the differential equations and not upon the partial recurrence of phenomena in their ensemble." Applying known laws of dynamics and physics to the problem, the author attempts to calculate future weather events by inserting numerical values in certain fundamental equations expressing the time rate of exchange of the easterly, northerly, and vertical components of the momentum of the air and of its density, water content, and heat content.

The scheme is reduced to a set of computing forms (noted below) for the use of "anyone who wishes to make partial experimental forecasts from such incomplete observational data as are now available. In such a way it is thought that our knowledge of meteorology might be tested and widened, and concurrently the set of forms might be revised and simplified."

Forms whereon to write the numerical calculations described in weather prediction by numerical process, L. F. RICHARDSON ([London]: Cambridge Univ. Press, 1922, forms 23; *rev. in Nature* [London], 110 (1922), No. 2771, pp. 762-765).—These are the forms referred to above.

The weather and cyclical fluctuations, W. W. BRYANT (*Econ. Jour.*, 31 (1921), No. 121, pp. 46-49).—This is a brief discussion of the validity of the various attempts that "have been made to obtain reasonably accurate forecasts of weather tendencies for long periods in advance."

With special reference to Beveridge's recent contribution to the question of weather and harvest cycles, which has been previously noted (*E. S. R.*, 47, p. 719), the author's general conclusion is that "considering how many causes, which are so apparently arbitrary as to be commonly called 'accidental,' affect the weather and the crops, it does not seem likely that the time has yet come for long-range forecasting to become a practical factor in the regulation of the world's food supply."

Weather cycles in relation to agriculture and industrial fluctuations (*Nature* [London], 110 (1922), No. 2774, pp. 889, 890).—This is a review of a joint discussion by Sir William Beveridge and others before the British Association for the Advancement of Science, September 7, 1922, dealing with studies which have been reported in large part in papers previously noted (*E. S. R.*, 47, p. 719).

It is claimed for Beveridge's investigations that they establish the existence, and persistence over more than 300 years, of definite periodicities in the yield of European harvests, some or all of which must be attributed to cycles in the weather, and open up the possibility of valuable forecasts of general conditions.

R. A. Fisher suggested that "a periodicity in yields is not necessarily an indication of a periodicity in weather since it may indicate merely a periodicity of economic conditions," and that the crop data for such an investigation should be obtained not under commercial but under experimental conditions. He pointed out that a comparison of crop data obtained at Rothamsted with the rainfall records "indicates that rainfall apparently accounts for from 30 to 50

per cent of the total variation in crop." In his opinion "in most features the succession of seasons appears to be wholly fortuitous," and "the crop can not be predicted even approximately without a detailed prediction of the weather."

Others questioned whether there is any correlation between price periodicity and meteorological periodicity, and it was suggested that Beveridge's correlation coefficient was too small to be of practical significance.

The periodic return of severe winters, E. ROGER (*Compt. Rend. Acad. Sci. [Paris]*, 175 (1922), No. 22, pp. 1089, 1090; *abs. in Rev. Sci. [Paris]*, 60 (1922), No. 24, p. 847).—A study of minimum temperatures, 1416-1912, indicates a period of 41 years, as suggested by Renou, as well as possible periods of 100 and 200 years.

Lightning and trees, V. SCHAFFERS (*Compt. Rend. Acad. Sci. [Paris]*, 175 (1922), No. 22, pp. 1087-1089; *abs. in Rev. Sci. [Paris]*, 60 (1922), No. 24, p. 847).—This article reports measurements of the potential of discharge of the leaves of a large number of species of trees under well-defined conditions. Studies were also made of the extent to which the leaf is capable of serving as a lightning conductor. No simple relation was shown to exist between the potential of discharge of the leaves and the frequency with which different species of trees are struck by lightning.

Climatology of Tunis, G. GINESTOUS (*Dir. Gén. Agr., Com., et Colon. [Tunis]*, *Bul.* 26 (1922), No. 111, pp. 549-663, pls. 40).—This is a review of the climatology of Tunis, especially those features of interest to agriculture, based upon 26 years' observations by the Meteorological Service of Tunis on pressure, temperature, precipitation, evaporation, wind, and casual phenomena. Text and tables are supplemented by numerous charts and diagrams.

The general characteristic of the climate is its extreme variability, due to opposing influences of the sea and the desert. The difference between the mean temperature of January and of July varies from less than 10 to more than 20° C. The interior regions are excessively hot, but the coast regions are temperate. The rainfall varies from less than 200 to over 1,480 mm. (7.9 to 58 in.) and the number of rainy days from less than 25 to over 140. There are three rainfall zones: (1) Very rainy, in which the precipitation is from 600 to 1,480 mm. and the number of rainy days 120 to 140; (2) rainy, in which the rainfall varies from 400 to 600 mm. and the rainy days from 60 to 100; (3) zone of little rainfall, 200 to 400 mm. and 40 to 70 rainy days; and (4) zone of very little rainfall, less than 200 mm. and 25 to 45 rainy days. The distribution of rainfall is very variable, comparing one season with another and one year with another. The conditions of temperature, sunlight, and wind are conducive to high evaporation.

Bibliography of meteorological literature (*Roy. Met. Soc. [London]*, *Bibliog. Met. Lit.*, 1922, Nos. 1, pp. 33; 2, pp. 35-53; *rev. in Nature [London]*, 110 (1922), No. 2774, p. 885).—These are the first and second numbers of separate half-yearly issues of the bibliography formerly published quarterly in the *Quarterly Journal of the Royal Meteorological Society*. The first number includes literature received in the library of the society or in the library of the Meteorological Office from September, 1920, to June, 1921. The second includes publications received from July to December, 1921. The arrangement is the same as that followed in the *Quarterly*, being a simplification of that adopted by the International Catalogue of Scientific Literature. The separate issue of this bibliography was decided upon to meet the needs of the "small body of workers actively engaged on meteorological research, and to others who desired to keep abreast of advances in meteorology."

SOILS—FERTILIZERS.

Agricultural-geological survey maps and their importance for agriculture and political economy, J. KIENDL (*Landw. Jahrb. Bayern*, 11 (1921), No. 3, pp. 131-147).—This discussion refers especially to the importance of soil surveys for agriculture and as an aid in solving problems of political economy.

Reparceling of lands and its relation to geology and soils, J. KIENDL (*Landw. Jahrb. Bayern*, 11 (1921), No. 3, pp. 97-130).—This is a detailed discussion of the reparceling of lands as it is frequently practiced in Europe, particularly under the intensive systems of agriculture and the involved highway systems in Germany. Special attention is drawn to the influence of geology, soil types, formations, and conditions, agricultural practices, and general physical factors of the landscape upon such reparceling.

Importance of and determination of the density in soils work, E. KRÜGER (*Internatl. Mitt. Bodenk.*, 11 (1921), No. 5-6, pp. 212-216).—The author holds that in all studies involving soil moisture the density or volume weight of the soil should always be determined. Practical methods used by the author in this work are described.

Adams County soils, J. G. MOSIER, F. W. WASCHER, W. R. LEIGHTY, H. J. SNIDER, and L. H. SMITH (*Illinois Sta. Soil Rpt.* 24 (1922), pp. 62, pls. 4, figs. 9).—This survey deals with the soils of an area of 542,816 acres in western Illinois. It lies in both the Kansan and Illinoian glaciations. The county is said to have extremes in topography. The northeastern part has large areas of extremely flat and originally poorly drained land, and the western and southern parts have extensive areas of hilly, almost untillable land mixed with areas of undulating tillable land.

The soils are of glacial and loessial origin. They are grouped as upland prairie, upland timber, terrace, old bottom land, late swamp and bottomland, and residual soils. Including water areas and rock outcrop, 25 soil types are mapped, of which the brown silt loam upland prairie soil and the yellow-gray silt loam and yellow silt loam upland timber soils cover 12.11, 27.38, and 21.36 per cent of the area, respectively.

The results of chemical analyses and field studies of the fertility requirements and crop adaptations of the prevailing soil types are also presented.

Studies of some characteristically widespread soil types of Upper Bavaria, H. NIKLAS (*Landw. Jahrb. Bayern*, 10 (1920), No. 9-10, pp. 363-408).—This is a report of a survey of the soils of an area of 50,000 hectares (123,500 acres) in Upper Bavaria in Germany. The work included studies of about 500 samples of soils from the area, of which over 80 chemical analyses and over 200 mechanical analyses were made. Measurements of electrical conductivity and of the moisture, air, and heat economy of the soils were also included.

Field tests were also conducted to determine the fertility requirements and crop adaptations of the prevailing soil types. The soils of the area are classed as reddish brown weathered loam, yellow loam, lowland terrace, moraine sand, shale marl, loess, stratified terrace, and tertiary soils.

Studies on soil and Baggererde samples from ponds and lakes in connection with plans for drainage. The chemical composition of flat moor soils, D. J. HISSINK (*Internatl. Mitt. Bodenk.*, 11 (1921), No. 5-6, pp. 166-183).—This is a summary of work previously noted from another source (E. S. R., 45, p. 325).

[**Soil studies at the Missouri Station**] (*Missouri Sta. Bul.* 197 (1922), pp. 81-89, figs. 3).—This is a continuation of a series of studies on soils and fertilizers at the station (E. S. R., 46, p. 315). Crop rotation and fertilizer

experiments by M. F. Miller, F. L. Duley, and O. B. Price have so far shown that the total crop increases resulting from the use of acid phosphate, steamed bone meal, and raw phosphate rock have been approximately equal.

Experiments to determine the best systems of soil management, by Miller, Duley, and Price, indicate the universal response to phosphates, a general though not universal response to lime, and a varied response to potash. Manure gave almost uniformly good returns, while rock phosphate paid in three cases and failed to pay in four. Little doubt is expressed that the most paying returns in most Missouri soils may be expected from the use of manure, available phosphoric acid, and lime, with the returns from potash varying with the soil type and the crop grown.

Studies by Miller, Duley, and Price of soil erosion under field conditions and under various crops and treatments showed that the most rapid erosion took place from scraped soils, and the largest amount of nitrogen was removed from cultivated soils. Continuous sod was very effective in holding the soil, and a rotation was more effective in this respect than continuous grain cropping.

Analyses by Miller, Duley, and Price of a worn soil, on which two nonlegume crops were grown and turned under for four consecutive seasons, showed an average accumulation during the four years of 348 lbs. of nitrogen and 4,344 lbs. of organic carbon per acre in the surface soil, due evidently to the fixation of nitrogen by *Azotobacter* or other free nitrogen-fixing forms.

Studies on the longevity of *Bacillus radicum* in soil by W. Albrecht showed that legume bacteria live for a considerable time even in dry soil. Even though the soils were dried in the sun they contained enough viable bacteria to produce inoculation. These 4-year tests are taken to indicate that soils once inoculated for soy beans and red clover will not need to be reinoculated when these crops recur in a 4-year rotation.

In studies of the relative values of different forms of phosphorus on thin soils, Miller, Duley, and Price found that these soils responded strikingly to soluble phosphates. Additions of 2 per cent of ammonia or of potash to a base of soluble phosphoric acid gave only slightly greater yields and net returns, the response being slightly better with ammonia than with potash.

A continuation of studies by Albrecht on nitrate accumulation in a soil as affected by the crop and cultivation confirmed the results previously reported (E. S. R., 45, p. 215). Experiments by Albrecht on the effect of different continuous treatments upon the nitrifying activity of soils showed that continuous cropping depressed nitrate accumulation by the removal of the lime from the soil. In no case was the power of nitrate production lost.

Studies by Miller and Duley on the temperature of manure stored in various ways showed that when manure was stored in a shallow, flat pile on the ground the temperature did not rise much above the air temperature, but when it was stored in a conical pile or in deep vats the temperature went to a much higher point, sometimes exceeding 160° F.

A brief description of studies by Miller and R. Bradfield on the composition and characteristics of the tight clay layer in the soils of the level prairies of Missouri is also presented.

Cultivation of agricultural soils, F. GLANZ (*Die Wühlarbeit im Ackerboden. Vienna and Leipzig: Carl Gerolds' Son, 1922, pp. [4]+133, pls. 6*).—This work comprises a summary of information on different methods of soil cultivation, and more especially those involving pulverization and scarification processes.

Soils.—I, Soils and their treatment.—II, Sandy soils, W. J. SPARFORD (*So. Aust. Dept. Agr. Bul. 162 (1921), pp. 20*).—This bulletin consists of two

parts. Part 1 deals with soils and their treatment and includes considerable general information. Part 2 deals exclusively with the sandy soils of South Australia, which have been formed mainly by moving water. These soils are not good agricultural soils and as a rule contain but little available plant nutrients. They are easily leached and after cultivation dry rapidly at the surface. The profitable handling of these soils is said to consist of frequent stocking and infrequent cropping. For the purpose of carrying much live stock, lucern has been found to be the most useful crop in a rotation consisting of bare fallow, wheat with lucern, and superphosphate, followed by three crops of lucern.

Peat land farming, F. J. ALWAY (*West. Canad. Soc. Agron. Proc.*, 2 (1921), pp. 56-65, figs. 4).—In a contribution from the University of Minnesota information is presented on the reclamation and utilization of peat soils, particularly those encountered in Minnesota. According to the fertilization needed when first brought under cultivation high-lime peats are classed as those needing no fertilization, those needing phosphate only, those needing potash only, and those needing both phosphate and potash. The last named are said to be the most common peats.

Ulmite, a constituent of black sandstone, T. STEEL (*Linn. Soc. N. S. Wales, Proc.*, 46 (1921), pt. 2, pp. 213-215; *abs. in Jour. Soc. Chem. Indus.*, 41 (1922), No. 7, p. 263A).—Studies are reported which showed that the grains of a black friable sandstone found along the coast of New South Wales are covered with a thin dark-colored film. This is readily separated and obtained free from the sand, and when dry forms a dark-brown powder. The properties and analysis of this powder agree closely with those for humus obtained from brown peat. The term "ulmite" is proposed for this form of humus.

The depletion of soils by chemical denudation, M. WHITNEY (*Science*, 56 (1922), No. 1433, pp. 216-218).—This is a brief review of studies conducted by the Bureau of Soils, U. S. D. A., on the subject, which indicates that in the breaking down of soil silicates to a point where the potash goes into solution, silica, alumina, and iron also go into solution in the same proportion they bear to the potash content of the original material. The difference is, however, that the solution of silica, alumina, and iron is a colloidal solution as distinguished from the true solution of the so-called soluble elements.

The opinion is expressed that until the actual loss through chemical denudation of silica, alumina, iron, potash, and other electrolytes in the colloidal state carried by rivers is determined, it is impossible to even speculate as to whether chemical erosion is a selective process, which might change the chemical composition of the soil, or whether materials leave the soil in about their original ratios, which would not materially change the chemical composition of the soil upon which water has acted.

The control of soil moisture by means of auto-irrigators, F. DE PERALTA (*Philippine Agr.*, 10 (1922), No. 10, pp. 467-477, pl. 1, figs. 2).—Studies conducted at the College of Agriculture of the University of the Philippines, on the relation of the growth of crops to different soil moisture contents when the amount of moisture in the soil is controlled by a modification of Livingston's auto-irrigator method, are reported.

It was found that the moisture content of soil in pots or any other container could be very well regulated and kept almost constant for an indefinite period by the use of auto-irrigators and mercury columns. In the case of lettuce, a noteworthy gain in both leaf area and dry weight was secured by the auto-irrigator method.

It is concluded that the constancy with which the soil moisture may be maintained by the use of auto-irrigators would make the method applicable for some types of physiological and ecological experiments.

The effects of moisture on the thermal conductivity of soils, G. B. SHANKLIN (*Jour. Amer. Inst. Elect. Engin.*, 41 (1922), No. 2, pp. 92-98, figs. 7).—Studies on the changes in thermal conductivity of soils caused by the presence of moisture are reported.

The dry thermal conductivity of soils was found to be somewhat dependent upon the size, shape, and arrangement of the particles or upon the volume of air interspaced with the particles. Coarse-grained materials, such as sand and gravel, had better thermal conductivity than fine-grained soil.

Moisture was found to be the predominating factor rather than the kind of material. The thermal conductivity of the dry soils such as sand, clay, gravel, etc., covered a range of from 0.002 to 0.0047 watt per cubic centimeter per 1° C., while the addition of moisture caused an increase to 0.017.

It is concluded that it is immaterial what kind of soil surrounds a conduit line except in so far as the ability of this soil to absorb and retain moisture is concerned.

A bibliography on the heating of cables in soils is included.

Soil colloids, C. B. CLEVINGER (*West. Canad. Soc. Agron. Proc.*, 2 (1921), pp. 66-70).—In a contribution from the Manitoba Agricultural College, general information on soil colloids is presented, together with a list of references bearing on the subject.

A new method for the quantitative determination of colloidal clay, R. SOKOL (*Internatl. Mitt. Bodenk.*, 11 (1921), No. 5-6, pp. 184-211, fig. 1).—A new method for the quick and easy determination of the quantity of colloidal clay in soils is described, which is based upon coagulation phenomena and the volume of the floccules in flocculated soils. The volume of colloidal clay is determined by subtracting the volume of the dust and clay materials determined by sedimentation from the volume of the floccules obtained by coagulation with sodium chlorid. Tests of the method with different soils and comparisons with other methods are described.

Relation between flocculation, adsorption, and charge of particles with special reference to hydroxyl ions, S. E. MATTSOn (*Kolloidchem. Beihefte*, 14 (1922), No. 9-12, pp. 227-313, pls. 2, figs. 7).—Studies conducted at the University of Göttingen on the influence of different ions including lime, iron, aluminum, and other metals on the flocculation of substances obtained from soils and tests of the stability of the aggregates formed in this manner are reported. An analysis and study of adsorption in soils is also included.

Hydroxyl ions were found to be extensively adsorbed in soils. They had a strong charging effect and in the presence of weakly or moderately precipitating cations also a direct dispersing effect. They exercised an indirectly precipitating influence in that they accelerated the adsorption of precipitating cations.

Flocculation occurred in the case not only of particles with reduced charges but also in the case of strongly charged particles when the number of adsorbed ions was large.

The adsorbed ions appeared to act as a combining medium between the particles, and it is considered possible that a positive ion will become attached to two negatively charged particles and thus cause a combination of these. For this reason the cation is considered to be a positively charged particle.

The hydroxyl ions are not considered in themselves to be injurious to the soil structure. The dispersing action apparently depends much more upon what cations predominate in the soil solution. The oxids and hydroxids of iron and aluminum were found to be negatively charged in aqueous suspensions. They became positively charged only through the formation of oxy-chlorid ions by the process of adsorption.

It is concluded that the power of soils to adsorb hydroxyl ions influences the solubility of different compounds and explains acidity phenomena in many soils.

Degree of acidity of soil, D. J. HISSINK and J. VAN DER SPEK (*Dept. Landb., Nijv. en Handel [Netherlands], Verslag. Landbouwk. Onderzoek. Rijkslandbouwp. oefsta., No. 27 (1922), pp. 146-161, fig. 1.*)—In a contribution from the Groningen Experiment Station a review is given of the factors affecting and controlling soil acidity and the theories as to their influence. Carbon dioxide, calcium carbonate, clay, and humus materials are considered to be the soil constituents which control the degree of acidity. The results of investigations into the degree of acidity of a large number of samples of typical Netherlands soils are summarized. As indicated by the H-ion determinations the upland peat humus soils are strongly acid, while the mixtures of upland peat with sand vary from acid to weakly alkaline, the lowland peat soils from moderately acid to very weakly alkaline, the down soils from very acid to weakly alkaline, the clay soils rich in humus from very acid to weakly acid in accordance with the lime content of the humus, and the clay soils deficient in humus from acid to weakly alkaline according to the lime content.

Studies of the relation between the degree of saturation of the soil solution and its acidity showed that the pH values increased and the acidity decreased as the saturation increased.

The relations between soil acidity and crop growth, buffer action of soils, and variations in soil acidity are also discussed.

Ultramicroscopic microbes in forest soils, E. MELIN (*Ber. Deut. Bot. Gesell., 40 (1922), No. 1, pp. 21-25.*)—Studies of humus extracts from forest soils are reported which showed that some of the microorganisms present in the humus pass through a coarse membrane filter. Humus extracts filtered through a medium membrane filter appeared to be sterile, but they decomposed gelatin. This action was more marked when the filtered extracts had been concentrated in a vacuum. Extracts filtered through a very fine membrane were sterile or at least were unable to decompose gelatin. These results are taken to indicate that these extracts contain proteolytic ferments which pass through medium filters but are retained on fine filters.

Does nitrification occur in sea water? C. B. LIPMAN (*Science, 56 (1922), No. 1453, pp. 501-503.*)—Studies conducted at the University of California to determine whether or not active nitrifying bacteria exist in sea water are briefly reported.

The conclusion is drawn that either the nitrifying bacteria are absent from sea water or they can not function in such concentrated salt solutions. In view of a recent finding that the nitrifying bacteria can withstand very high salt concentrations, it is considered reasonably safe to conclude that the nitrifying bacteria are absent from open sea water, and that, therefore, no nitrification occurs therein.

Disinfection of experimental soils, V. MANVILLI (*Italia Agr., 58 (1921), No. 10, pp. 309-311.*)—Experiments with potatoes on a siliceous clay soil and subsoil of the same material are reported. These showed that partial sterilization of the soil with sulphur, potassium permanganate, calcium hypochlorite, carbon disulphid, and lysol produced increases in yield which were about equal in amount.

[Fertilizer studies at the Delaware Station], G. L. SCHUSTER (*Delaware Sta. Bul. 133 (1922), pp. 6, 7, 8.*)—Laboratory studies with lime are said to have shown that all forms of lime are equally valuable in decomposing green manure when measured by the amount of carbon dioxide given off. However, magnesium oxide and magnesium carbonate cause more carbon dioxide to be given off the first 10 days than calcium oxide or calcium carbonate. After the

first 10 days the amount of carbon dioxide given off was about the same for each form of lime for a 90-day period.

The results of field tests were about the same when measured in terms of crop yields. All forms of lime were about equally valuable when applied according to their respective neutralizing powers. The addition of a complete fertilizer with the different kinds of lime increased crop yields. Field tests with carriers of phosphoric acid are said to have shown that acid phosphate, sodium phosphate, basic slag, and bone meal are of about equal value and are considerably better than rock phosphate or bone black.

A study of crop rotations and of soil response to applications of various plant nutrients when used alone and in combination with and without lime showed that phosphoric acid and potash give the most marked results. The results to date are said to indicate that potash is one of the limiting elements of the Sassafras loam and silt loam soils. It stimulated clover, soy beans, and corn, and greater disease resistance and more vigor were displayed in crops where it was used as an ingredient of the fertilizer. A combination of acid phosphate and potash gave the most consistent results and the largest profit on all crops. Lime with fertilizers or manure increased corn yields, but without fertilizers it gave negative results. It also increased the yields of soy beans and hay.

Studies of crop rotation v. continuous culture indicated that wheat in the crop rotation with a complete fertilizer produced from 5 to 7 bu. more than in continuous culture with a complete fertilizer. The yield of corn was also greater in the rotation than in the continuous culture.

A thirty-year fertilizer test, S. B. HASKELL (*Massachusetts Sta. Bul.* 212 (1922), pp. 127-158, pls. 2, figs. 3).--The results of this study, begun in 1889, to determine the fertilizer requirements of different crops in different soils are summarized in this bulletin. Progress reports of this work have been noted from time to time (*E. S. R.*, 46, p. 19).

It is concluded that the greatest service which these field tests have rendered has been the establishment of the fact that individual crops vary in their nutrient requirements, and that fertility practice may be affected more by the kind of crop than by the type of soil on which it is grown. A complete fertilizer has been found more certain to produce satisfactory results than any other fertilizer treatment where the soil is farmed without live stock and no manure is returned to the land. The response of crops to nitrogen has been found to be affected by nearness in the rotation to a legume crop. The tests indicated that where corn is grown either the first or second year following a legume the use of fertilizer nitrogen does not result in anything more than a moderate return. The character of the season did not seem to have a dominant influence on the functioning of this nutrient when applied in artificial form.

Large returns were obtained from the use of potash where the whole crop was removed and manure was not returned to the soil. The greater the extent to which the crops were removed, the greater relatively was the need for fertilizer potash. On the other hand, the greater the extent to which the crops produced were fed on the farm and the manure returned, the lower was the need for potash.

The use of lime in the cropping system followed increased the size of crops very significantly, although it had no effect upon the availability of soil potash. The tests indicated the great dependence of clover on a generous supply of lime, potash, and phosphoric acid. Soluble phosphates were found to reduce, although not to eliminate, the crop damage caused by acidity. Crops varied enormously in their response to the different plant nutrients.

Experiments with fertilizers (*South Carolina Sta. Rpt. 1922*, pp. 15-19).—The results of comparative tests of nitrogenous fertilizers conducted for several years are said to have shown that usually combinations of several sources of nitrogen give the best results. During 1921 the highest yield of cotton at the Peedee Substation was secured from blood and the next highest from ammonium sulphate, while the highest yield of corn was obtained with calcium cyanamid, and the next highest with ammonium sulphate.

Experiments on the time and method of applying fertilizers have so far indicated that, under heavy boll-weevil infestation during a rainy season, the best results were obtained by using side applications of fertilizer. General data from cooperative fertilizer tests on different soil types are also briefly presented.

Standard fertilizers for Michigan, M. M. MCCOOL, G. M. GRANTHAM, and P. M. HARMER (*Michigan Sta. Circ. 53* (1923), pp. 4).—Practical information on standard fertilizers for use on certain crops in Michigan soils is briefly presented.

Preservation and use of poultry manure, J. B. ABBOTT (*Mass. Agr. Col. Ext. Leaflet 57* (1922), pp. 3).—Practical information on the preservation and use of poultry manure as a fertilizer in Massachusetts is presented in this publication. Because of the high availability of its nitrogenous content it is considered peculiarly adapted to those crops which respond well to a liberal amount of quickly available nitrogen. Normally single applications of poultry manure should not exceed from 2 to 3 tons per acre, both because of danger of burning the crop or giving it an excess of nitrogen and on account of the probability of heavy loss by leaching.

Experiments with green manure crops, G. L. SCHUSTER (*Delaware Sta. Bul. 133* (1922), p. 9).—Experiments with red, crimson, and sweet clover, alfalfa, vetch, cowpeas, soy beans, and rye are said to have shown that any cover crop increased the yield over the check, and that legume cover crops increased the yield over nonlegumes.

Preparation of peat composts, A. P. DACHNOWSKI (*U. S. Dept. Agr., Dept. Circ. 252* (1922), pp. 12).—This circular discusses the different kinds of peat deposits and their structure and methods of excavation and presents information on the composting of peat with stable manure, sewage, fish scrap, and molasses waste from sugar factories. It is stated that among the most essential factors making for the production of a good compost with peat are a proper proportion of materials, a favorable supply of air, and suitable temperature and moisture conditions.

The Donnan program of investigation for the Chilean nitrate industry, A. W. ALLEN (*Chem. and Metall. Engin.*, 27 (1922), No. 23, pp. 1121-1128, figs. 12).—The present method of caliche treatment is outlined, and a critical examination is made of a recent suggestion that the operation of the Shanks process should be the object of intensive scientific research.

Transformation of gypsum into ammonium sulphate, C. MATIGNON and M. FRÉJACQUES (*Compt. Rend. Acad. Sci. [Paris]*, 175 (1922), No. 1, pp. 33-35, fig. 1).—Studies on the production of ammonium sulphate by the double decomposition of gypsum by ammonium carbonate are reported.

It was found that this decomposition proceeded slowly at first for a definite period and then more rapidly. The fineness of the particles of gypsum had a marked influence on the speed of the reaction. Decreasing the speed of the agitation apparently decreased the speed of decomposition with gypsum particles of the same size. The presence of ammonium sulphate in the initial solution slowed up the reaction. Dilution of the ammonium carbonate solution diminished the speed of transformation. In most cases equilibrium was practically reached after 2.5 hours of agitation.

Practical conditions for the use of calcium cyanamid as a fertilizer, P. MAZE (*Compt. Rend. Acad. Sci. [Paris]*, 175 (1922), No. 22, pp. 1093-1096).—Field experiments with wheat, oats, and barley on acid, sandy, and clayey soils to determine the influence of mixing pulverized peat with calcium cyanamid on the fertilizer value of the latter are reported. The cyanamid was also compared with ammonium sulphate mixed with peat.

The ammonium sulphate mixed with peat gave better results than the cyanamid in most cases, except where the smallest proportion of peat was used. The best results were obtained with the cyanamid when it was mixed with ten times its weight of peat. When this mixture was applied to the soil at the time of seeding, the peat appeared to protect the young seedlings against the toxic action of the cyanamid.

The influence of nitrogenous fertilizers on the alkaloid content of lupines, VOGEL and E. WEBER (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 2, *Wiss.*, pp. 85-95; *abs. in Jour. Chem. Soc. [London]*, 122 (1922), No. 718, I, pp. 798, 799).—Experiments are reported which showed that the alkaloid content of blue and yellow lupines, respectively, varies according to the manner in which the plants receive their nitrogen, whether through the medium of the nitrogen-fixing bacteria in the root nodules or from nitrogenous fertilizers. Smaller contents of alkaloid were observed in the latter than in the former type of nitrogen nutrition.

The results of a study on the effect of certain materials for artificial inoculation showed that Azotogen and nitragin gave satisfactory results. Azonutrin gave less satisfactory results, while legumin was ineffective.

The phosphoric acid content of liquid sewage, E. DEUSSEN (*Chem. Ztg.*, 46 (1922), No. 116, pp. 876, 877).—Studies conducted at the University of Leipzig on the solubility of the phosphoric acid content of liquid municipal sewage from sewers and clarification tanks are reported.

These showed that 1 gm. of loose white brown coal briquet ash easily absorbed about 1.5 gm. of liquid sewage, while the same quantity of the compact brown ash absorbed only 1 gm. of sewage. Apparently little phosphoric acid was retained by the briquet ashes. The phosphoric acid content of the liquid sewage averaged 0.32 per cent. During sedimentation the liquid sewage became richer in phosphoric acid since, on account of a deficiency in lime and magnesia, about 15 per cent of the phosphoric acid remained in solution. Water-soluble lime and magnesium salts completely precipitated out the dissolved phosphoric acid in fermenting ammoniacal urine.

It is concluded that important amounts of phosphoric acid are lost through municipal sewers, but that the phosphoric acid content of liquid sewage is present for the most part in insoluble forms.

Rhenania phosphate, A. MESSERSCHMITT (*Ztschr. Angew. Chem.* 35 (1922), No. 79, pp. 537-543, *figs.* 12).—The composition and method of manufacture of Rhenania phosphate are briefly discussed, and a summary is given of the results of laboratory and field experiments conducted at several European agricultural experiment stations on the fertilizer value of this material. Manufacturing problems are briefly discussed.

Comparative assimilability of tricalcium phosphate and the phosphates of aluminum and iron, C. BRIOUX (*Compt. Rend. Acad. Sci. [Paris]*, 175 (1922), No. 22, pp. 1096-1099).—Pot studies using sand cultures of six different crops to compare tricalcium phosphate with the phosphates of aluminum and iron as sources of phosphoric acid are reported.

The aluminum phosphate gave better results than the tricalcium phosphate in the production of dry matter in four out of six cases. It was superior to the iron phosphate in five out of six cases. The iron phosphate, while inte-

prior to the tricalcium phosphate in five out of six cases, gave noteworthy increases in dry matter, especially in the cases of barley and buckwheat. The assimilation of phosphoric acid from aluminum phosphate by the crops was greater in nearly every case than that from the other two phosphates.

It is concluded that in determining the available phosphorus of soil a solvent must be used which will indicate the phosphates of iron and aluminum as well as the alkaline phosphates.

Lime for Van Buren County soils, M. M. McCool, J. O. Veatch, and F. W. Trull (*Michigan Sta. Circ. 54* (1923), pp. 4, fig. 1).—A map of Van Buren County, Mich., showing the lime requirements of the 35 different soil types in the county is presented and discussed.

Sulphur, pyrites, and sulphuric acid (*Commerce Mo., 4* (1922), No. 8, pp. 20-28).—Data on the production, export, and import of sulphur, pyrites, and sulphuric acid in the United States and foreign countries are summarized in this report. It is shown that the United States during the last three years has taken first place in the supply of sulphur to the world, with Italy second and Japan third.

The rôle of manganous fertilizers in agriculture, H. Bocher (*Compt. Rend. Acad. Agr. France, 8* (1922), No. 9, pp. 323-325).—A brief review of the results of different studies on the fertilizing value of manganese is given, indicating that it is a catalytic body and a fertilizing agent.

Production and value of mineral products in Michigan for 1920 and prior years, L. P. Barrett, H. M. Martin, and W. I. Robinson (*Mich. Geol. and Biol. Survey Pub. 32, Geol. Ser. 26* (1922), pp. 145).—This report is in two parts and deals with metallic and nonmetallic minerals. Under nonmetallic minerals, sections are included on magnesium, cement, potash, gypsum, limestone and lime.

Inspection of commercial fertilizers for 1922, H. R. Kraybill, T. O. Smith, and C. P. Spaeth (*New Hampshire Sta. Bul. 206* (1922), pp. 16).—This bulletin contains guarantees and actual analyses of 97 samples of fertilizers and fertilizer materials collected for inspection in New Hampshire during 1922. Of these, 22 showed a deficiency of 0.2 per cent in one or more of the nutrients nitrogen, phosphoric acid, and potash.

Analyses of commercial fertilizers, fertilizer supplies, and home mixtures, 1922, C. S. Cathcart (*New Jersey Stat. Bul. 371* (1922), pp. 35, fig. 1).—This bulletin reports guarantees and actual analyses of 641 samples of fertilizers and fertilizer materials collected for inspection in New Jersey during the spring of 1922. These included 204 samples of fertilizer materials, 21 home mixtures, 350 complete commercial fertilizers, 4 commercial fertilizers containing phosphoric acid and potash, and 62 duplicates.

Fertilizer control, J. L. Hills, C. H. Jones, G. F. Anderson, and A. S. Lushman (*Vermont Sta. Bul. 228* (1922), pp. 3-15).—This section of this report summarizes the results of actual analyses of 617 samples of fertilizers and fertilizer materials, representing 203 brands, collected for inspection in Vermont during 1922, together with statements as to whether or not the guarantees were met.

AGRICULTURAL BOTANY.

[Report of the] department of plant physiology, E. M. R. Lamkey (*Delaware Sta. Bul. 133* (1922), pp. 33, 34).—In continuation of previous reports (E. S. R., 46, p. 627), the author claims that the different soil treatments employed in a study of changing permeability have resulted in quantitative and qualitative response in regard to the permeability of the tissues of

peach trees. Most of the changes have been in degree, although some rather remarkable qualitative differences due to fertilizer combinations were observed.

In an investigation of the reaction of enzymes to solutions within the peach tree, the author found that nitrogen is apparently the chief limiting factor in peach production through the influence that fertilizers have on the carbohydrate metabolism of the plant.

Employment of enzymatic activity as a limiting factor in the production of corn has resulted in the development of vigorous close-bred types in the separation of productive and nonproductive strains.

A new and efficient respirometer for seeds and other small objects, G. T. HARRINGTON and W. CROCKER (*Jour. Agr. Research* [U. S.], 23 (1923), No. 2, pp. 101-116, pl. 1, figs. 2).—A description is given of a respirometer designed for experiments on small objects, and directions are given for its use.

Respiration of apple seeds, G. T. HARRINGTON (*Jour. Agr. Research* [U. S.], 23 (1923), No. 2, pp. 117-130). Using the respirometer mentioned above, the author determined the respiratory intensity of dormant apple seeds as being very low. The respiratory intensity of seeds capable of germination was found to be higher, and with advancing germination it becomes very high but soon falls if the germinated seeds are kept at too high a temperature. Removal of the outer seed coats or both seed coats was found to increase respiration and accelerate germination.

The respiratory quotient of dormant apple seeds at ordinary temperatures corresponded to the complete oxidation of fats or to only a slight increase in sugars. It increased with temperature, indicating possibly an oxygen deficiency, and decreased with temperature, indicating a storage of oxygen. The respiratory quotient was found to become low with advancing germination, indicating the rapid transformation of fats and accumulation of sugars.

Temperature changes are said to exert a stimulating effect on the respiration of dormant apple seeds.

Respiratory intensity, respiratory quotients, and temperature coefficients are said to be affected by the previous treatment of the seeds, being higher after treatment which tends toward afterripening and lower after treatment which induces deeper dormancy. The temperature coefficients are reported to be different for different steps in the oxidative processes which constitute respiration, and these differences are said to be related to the different temperature effects upon the physiological condition of the living embryo.

Ecology of *Tilia americana*.—II, Comparative studies of the foliar transpiring power, J. E. CRIBBS (*Bot. Gaz.*, 71 (1921), No. 4, pp. 289-313, figs. 10).—This is an extension of investigations previously noted (*E. S. R.*, 43, p. 223), being concerned with the data recorded for the same species as obtained from a wide range of habitats on clay soils, and carried out according to methods essentially similar to those previously employed.

The morning rise in the foliar transpiration index for *Tilia* is commonly much slower for the clay series of environments than for the sand dunes and the maximum attained is comparatively much lower. These and related facts are detailed.

The transpiration stream shows a simple curve for readings taken on forested clays, rising gradually to a maximum at noon and falling at approximately the same rate to the night level. The effect of thundershowers is recorded in a sharp reduction in the transpiration index. Partial abscission produces an effect not unlike that found to accompany the development of a wilting coefficient. A wilting coefficient did not develop in any of the clay soils, and there was always a considerable amount of growth water available, but its occurrence on the sand series produced an effect closely similar to that occasioned by

abscission. Sunlight affects the transpiration stream through its influence in initiating stomatal movements and has particular reference to the morning rise. Relative humidity is a very potent factor in influencing the transpiration index. Growth water exerted less influence in modifying the transpiration rate than most of the atmospheric factors. The part played by soil temperature in maintaining the transpiration stream is given more importance than has generally been ascribed to this factor.

The highest average transpiring power recorded for the clays, with the exception of the prairie data, was that registered for the swamp habitat. The variation in average transpiring power from day to day is greater for the mesophytic forest than is the difference between the average rates for the most mesophytic and most xerophytic stations, if we consider the clay series only and disregard the prairie record. The converse is true for the dune series. Daily variations in the transpiration stream are most pronounced in the xerophytic situations, and least so in the strongly mesophytic ones. The average transpiring power is less in deep forests and moist ravines than in open woodlands and less in open forests than in exposed positions on clay. The greatest transpiring ability was recorded on the open sands where there was no humus and on the prairie. The transpiration curve characteristic of the prairie station is closely similar in its essential features to the curves representing the open dune sands. The highest transpiration rates are associated with a low growth water, which is not interpreted as being in any way causal, but as evidence that growth water is of relatively little significance so far as transpiration is concerned until it approaches the wilting coefficient.

On the behavior during drought of leaves of two Cape species of *Pas-serina*, with some notes on their anatomy, D. THORAY (*Ann. Bot. [London]*, 35 (1921), No. 140, pp. 585-601, figs. 13) - A study of structure and behavior in *P. filiformis* and *P. falcifolia* (?) is described as these are affected by drought in South Africa.

The water content of shoots with the leaf grooves closed ranged in March, 1920 (late in a very dry summer), from 34 down to 25.7 per cent, the water content of fully turgid shoots at this time being only 47 per cent. At the end of the winter rainy season (October) the water content of shoots with new growth was about 60 per cent.

Evidence is adduced for attributing closure to cohesion forces developed in the outer epidermis, the cells of which are large and deep, and are provided with a very thick cuticle. As they contract with loss of water their lateral walls are thrown into bellowslike folds. The mesophyll, however, contracts in volume during closure at least as much as the epidermis, and the palisade tissue may show fine bellowslike foldings of the walls. Reasons are given for regarding water storage as at most a subsidiary function, of little importance in prolonged drought, and other advantages of a deep-celled epidermis are considered, especially in relation to the closing mechanism and screening from intense insolation.

Reserve food materials in vegetative tissues, G. M. TUTTLE (*Bot. Gaz.*, 71 (1921), No. 2, pp. 146-151).—In view of the importance of the distribution of starch and fats as food-reserve substances in vegetable tissues and its connection with investigations regarding the effect of low temperatures on cells, it was thought desirable to investigate the conditions prevailing in some trees and shrubs in northern Alberta, the results of which are briefly indicated.

All the species examined showed a high starch content during the summer, which disappeared during October. All the trees and shrubs examined contained oils and fats as food reserve during winter with the exception of *Loni-*

cera glaucescens and *Crataegus* sp. The presence of sugar was demonstrated in many of the species, quantitative determinations in a few places giving a total sugar content ranging from 0.5 to 2 per cent. Falling deciduous leaves contained oils and fats but no starch. Most of the species of alpine Salicaceae and Ericaceae examined showed the presence of both starch and oil during the vegetative season. *Gaultheria ovatifolia*, a lowland species, showed oil only. The ability to form starch does not seem to be associated with the climatic conditions resulting from high altitudes.

Effect of light on germination of light-sensitive seeds, W. A. GARDNER (*Bot. Gaz.*, 71 (1921), No. 4, pp. 249-288).—An attempt has been made in this investigation to discover the fundamental relation of light to the germination of seeds and to show just what light does to start germination.

The seeds of *Rumex crispus*, *Datura stramonium*, and *Phoradendron flavescens* were found to be light sensitive. The germination of seeds of *R. crispus* and *P. flavescens* was promoted by light, but this hindered the germination of seeds of *D. stramonium*. Abrasion and removal of coats (ovary walls) of *R. crispus* seeds promoted their germination in darkness. Treatment of seeds of *R. crispus* and *Oenothera biennis* with concentrated sulphuric acid caused an increase in the percentage of germination in darkness. No reciprocal relation was found between the effects of light and temperature. Light was not necessary for the absorption of sufficient water for germination.

Injection of water did not yield increased germination in darkness. Almost all kinds of single electrolytes, regardless of the nature of the ions, seemed to promote germination of seeds of *O. biennis*, *Nicotiana tabacum*, and *Verbascum thapsus* in darkness. Embryos of seeds incubated in light became more acid than those incubated in darkness. Light seemed to activate lipolytic enzymes which hydrolyzed fats to fatty acids.

In darkness the germination of seeds of *R. crispus* was promoted (increased) by hot water treatment, abrasion, treatment with concentrated sulphuric acid, increased oxygen pressure, fluctuating temperatures, and soaking in solutions of hydrochloric acid, sodium sulphocyanate, and hydrogen peroxid. In *N. tabacum* it was promoted by soaking in solutions of hydrochloric acid, sodium sulphocyanate, and hydrogen peroxid, as well as by the use of many single electrolytes as substrata. In *V. thapsus* it was promoted by the action of light, fluctuation of temperature during incubation, alternating high and low temperatures, soil, and many single electrolytes as substrata. In *O. biennis* it was promoted during certain seasons by hot water treatment, sulphuric acid, preliminary incubation at low temperature, incubation in alternating high and low temperatures, and single electrolytes as substrata. In *Daucus carota* it was promoted by increased oxygen pressure and preliminary incubation at low temperature, while it was hindered by soaking in hydrochloric acid and by the use of single electrolytes as substrata.

Influence of environment on sexual expression in hemp, J. H. SCHAEFFNER (*Bot. Gaz.*, 71 (1921), No. 3, pp. 197-219, pl. 1, fig. 1).—The study of hemp (*Cannabis sativa*), originally undertaken to determine any influence of environment on the sex ratio, was extended and modified to include problems more fundamental than the mere changing of the sex ratio (*E. S. R.*, 48, p. 127).

Intermediate plants occurred, bearing both stamens and carpels, and also an endless profusion of abnormal flowers involving many sorts of sexual expressions. Complete reversal of sexual expression under the influence of abnormal environment was studied during three years, and it was found that hemp planted in the spring in the open, under normal conditions, developed as pure carpellate and pure staminate individuals, no confusion of sexuality occurring. The ratio between carpellate and staminate individuals was about 1:1, with

large deviation in either direction in some of the plats. Hemp planted in winter in the greenhouse on shallow benches with low light intensity showed great confusion in sexual expression. Both carpellate and staminate plants showed reversal in their growing period to the opposite sexual state. In extreme cases 88+ per cent of carpellate plants showed reversal to maleness, and 80 per cent of staminate plants showed reversal to femaleness. Both staminate and carpellate plants, though showing decided sexual dimorphism, contained all the factors and abilities of both sexes. There is no question of a homozygous or heterozygous condition being involved. The staminate and carpellate individuals contain the potentialities for the perfect development of the opposite sex. Reversal of the sexual state takes place in the vegetative tissues and has no relation to a reduction or segregation of chromosomes or their possible hereditary factors. The sexual reversal is of all degrees of intensity, from very imperfect expressions of the opposite organs to completely normal development.

Sexuality is a state or condition not Mendelian in nature, but related to the functional activity of the plant and profoundly influenced by environment. Maleness and femaleness in hemp are probably controlled by the metabolic level of the cells, and sex reversal takes place when the metabolic level is decidedly changed or disturbed.

Any tissue in its growth may be in a neutral state of varying degrees of intensity and during its continued growth can pass from one state to the other without any reference to chromosome segregation or combination which are the ordinary causes of Mendelian phenomena.

Sex is subject to experimental control in the individual in such dimorphic, dioecious species as hemp. Such control can be exercised in various ways by changing the ordinary factors of environment, and, therefore, presumably also by chemical and physical stimuli of various kinds.

FIELD CROPS.

The 1,000-kernel weight of seed in relation to experimental error, M. O. MALTE (*Sci. Agr.*, 3 (1922), Nos. 2, pp. 69-71; 3, pp. 119-122).—The author cites data to prove that different varieties within the several field crops may exhibit great differences in respect to their 1,000-kernel weights. Equal weight amounts of seed of very closely related varieties may contain decidedly unequal numbers of seed, and consequently unequal thickness of stand may be obtained with the different varieties if equal amounts of seed are sown. To obtain as equal stands as possible in variety tests, the 1,000-kernel weight must be considered, and varying amounts of seed of different varieties, calculated on the principle that equal numbers of germinable seed should be applied to equal unit areas of land, should be seeded. The weight amount of seed of a variety which should be seeded per unit area can be ascertained by the formula

$$\frac{w}{g \cdot p \cdot c}$$

where w is the 1,000-kernel weight, g the germination, p the purity, and c the required number of germinable seeds per unit area.

[Seeding upland moor meadows], H. WITTE (*Landtmannen*, 5 (1922), No. 49, p. 776).—The results of experiments conducted for five years at Flahult to determine the best time for seeding meadows on upland moor soils are briefly noted. The seed mixture which was sown without a nurse crop the middle of May, June, July, and August consisted of alsike clover, white clover, timothy,

meadow foxtail, meadow fescue, and blue grass. The June seedlings produced the largest percentage of clover. It is concluded from the results in general that, under the conditions prevailing at Flahault, meadows seeded on properly prepared soil during the latter part of June and early in July may be expected to produce the best yields of hay in quality as well as in quantity.

[Field crops work at the Georgia Coastal Plain Experiment Station in 1920], S. H. STARR (*Georgia Coastal Plain Sta. Bul. 1 (1921)*), pp. 7-14, figs. 6).—Experiments with field crops during the first year of the station are described. The continuation of this work has been noted (*E. S. R.*, 48, p. 128).

The leading varieties included Georgia Red wheat, South Georgia rye, Red Rustproof (Appler) oats, Whatley corn, and Cleveland (Fitzpatrick) and Webber cotton. Sweet potatoes on new land yielded decidedly less at about double the cost per bushel as on old land. November 24 seedlings of oats heavily outyielded December 20 seedlings. Rhodes grass made 3,753 lbs. per acre on low, moist land and 1,120 lbs. on ridge land, both Tifton sandy loam. A test of velvet beans in crop and comparisons of millets and of cowpea varieties are also noted.

[Report of field crops work in Missouri, 1921-22], W. C. ETHERIDGE, C. A. HELM, L. J. STADLER, and O. W. LETSON (*Missouri Sta. Bul. 197 (1922)*), pp. 66-68, 69, 70).—The continuation of earlier projects (*E. S. R.*, 46, p. 326) is described.

Fulcaster led in yields among the wheat varieties at Warrensburg and Stark City, Fultz at Maryville, and Poole at Cuba. However, the differences were not enough to indicate the invariable superiority of one variety. Two selections of Michigan Wonder have outyielded the parent variety by 3.4 and 4.9 bu. per acre.

Red Rustproof was outstanding in tests of oats varieties at Maryville with 55.8 bu. and at Warrensburg with 26.1 bu. per acre. As in preceding seasons, the earlier varieties outyielded the later sorts. Work with pure-line selections of oats and with hybrid progenies is also noted.

Orange, the highest yielding sweet sorghum, nearly doubled the yield of Boone County White, the leading corn variety, in pounds of dry matter per acre.

The yields of Oderbrucker, the leading barley, were materially lower at Columbia and Warrensburg than those of the better oats varieties, but at Maryville barley compared very favorably with oats. Trebi and Sandrel, obtained from the U. S. Department of Agriculture, were the leaders in the nursery test at Columbia.

Application of 300 lbs. of acid phosphate per acre to cotton on the Lintonia fine sandy loam of southeast Missouri produced a yield nearly 50 per cent greater than that of untreated plats and with earlier maturity. Small applications of potash apparently had no effect on yield or maturity. Acala, with 560 lbs. of lint per acre, and Cleveland, with 526 lbs., were foremost in cotton tests in 1921.

Sudan grass in rows 3 ft. apart on two different types of soil yielded practically the same as when drilled solid. When seeded thick with a grain drill the hay was of a much finer quality and the seed somewhat smaller.

The average acre yields of soy bean seed at 5 points were much greater than those of cowpeas, although hay yields were about the same.

[Report of field crops work in South Carolina] (*South Carolina Sta. Rpt. 1922*, pp. 7-14, 49, 50, 53, 54, 55, 56, 58-60, 61, 62, 63, 64, figs. 6).—Velvet beans, cowpeas, and soy beans were the leading companion crops for corn in the order named. The yields of both cotton and corn in rotation were maintained when cowpeas were broadcasted in the corn annually at the Pee Dee Sub-

station. Both crimson clover and bur clover are recommended as winter cover crops, but on poor land the best results were had with rye and vetch. Disking followed by broadcasting proved to be an economical and practical method of seeding carpet grass and lespedeza at the Coast Substation. Small applications of sodium nitrate and acid phosphate appeared to hasten the development of pastures on the poor lands very materially.

The leading varieties of cotton at the station were College No. 1 and Dixie Triumph in 1921 and Lightning Express and Express strains in 1922; at the Pee Dee Substation, Cleveland, Dixie Triumph, and Deltatype Webber in 1921 and Mexican Big Boll and Lightning Express in 1922; and at the Coast Substation Cleveland in 1921 and Cleveland and Dixie Triumph in 1922. General recommendations, except for Express and Deltatype Webber, have been noted earlier (E. S. R., 44, p. 524). Results to date indicate close spacing for maximum yields. The best results at the Coast Substation were had where a side application of cottonseed meal and sodium nitrate was made on June 19, and the next best where all the fertilizer was put under the cotton at planting.

Experiments showing the value of rotations are summarized, together with the results of variety trials with corn, sweet potatoes, soy beans, and velvet beans, and notes on breeding work with cotton, wheat, oats, rye, barley, corn, velvet beans, peanuts, potatoes, and sweet potatoes.

Certified Irish Cobbler potato seed from Virginia, Vermont, New York, Wisconsin, and South Carolina yielded in the order named. The low yield of the local seed was thought due mainly to the poor condition of the seed tubers. Certified Irish Cobbler seed made better stands and larger yields than noncertified seed. Nitrogen from organic sources gave better results than that from inorganic sources when applied to potatoes at the Coast Substation.

[Report of field crops work in Assam], J. McSWINEY, L. BARTHAKEER, and J. N. CHAKRAVARTY (*Assam Agr. Dept. Rpt. 1922*, pp. 3, 4, 5, 6-8; also in *Agr. Expts. and Demon. Assam, Rpt., 1922*, pp. 5-24, 33-35, 40-47, 57-68, 73-85, 97-110).—Experiments including varietal and fertilizer trials and breeding work with potatoes, rice, and sugar cane, and tests of forage and fiber crops are reported in continuation of earlier work (E. S. R., 46, p. 531).

[Report of field crops work in the Central Provinces and Berar, India, 1920-21], S. T. D. WALLACE, C. MAYADAS, J. H. RITCHIE, R. G. ALLAN, ET AL. (*Cent. Provs. and Berar [India] Dept. Agr., Agr. Stas. South. Circle Rpt. 1921*, pp. 3-12, 20-31, 38-46, 49-51, 55-67; *West. Circle Rpt. 1921*, pp. 3-13; *North. Circle Rpt. 1921*, pp. 4-13, 17, 23-26, 34-46, 61; *Expt. Farm. Agr. Col., Nagpur, Rpt. 1921*, pp. 4, 5, 10-17; *Agr. Col., Nagpur, Bot., Chem., and Mycol. Research [etc.], Rpt. 1921*, pp. 11-14).—In addition to reports of the progress of cultural, fertilizer, rotation, and variety tests (E. S. R., 46, p. 436) and breeding work with cotton, jowar, rice, wheat, sugar cane, and miscellaneous field crops, results of analyses of sugar-cane varieties are tabulated.

[Report of field crops work in Kenya, 1920-21], A. J. WILSON, G. M. HAMILTON, T. D. MAITLAND, F. B. BUTLER, and H. H. HOLDER (*Kenya Colony Dept. Agr. Ann. Rpt. 1920-21*, pp. 95-107, 113-117, 127-130, 132, 133, 138, 139).—The experimental work reported included varietal trials with wheat, corn, beans, peas, peanuts, flax, and potatoes; field tests with barley, teff grass, and miscellaneous cereal, root, forage, and fiber crops; and retting experiments with flax. The rice and sugar industries in the colony are described briefly.

[Report of field crops work in Madras, 1920-21], G. R. HILSON (*Madras Dept. Agr. Rpt. 1920-21*, pp. 8-10, 11, 13-15, 20, 21).—Cultural, fertilizer, and

varietal tests and breeding work with sugar cane, cotton, rice, and miscellaneous grain and forage crops are reported on as heretofore (E. S. R., 45, p. 532).

[Report of field crops work in Mesopotamia in 1921], R. THOMAS ET AL. (*Mesopotamia Dept. Agr. Admin. Rpt. 1921*, pp. 9-11, 25, 26, 33, 34, 41-43, 51-53, 55-59, 68-71).—The continuation of work with field crops along the same general lines as heretofore (E. S. R., 46, p. 436) is reported.

[Report of field crops work in Uganda in 1921], S. SIMPSON ET AL. (*Uganda Dept. Agr. Ann. Rpt. 1921*, pp. 6-8, 18-21, 21, 22, 26, 29, 31-35, 37-39, 41-44, 65-68, 70, 71).—The continuation of work with field crops along the same general lines as recorded heretofore (E. S. R., 46, p. 634) is described, together with analyses and yields of sugar-cane varieties and reports of the Imperial Institute on starches from cassava, arrowroot, and yam bean tubers (*Pachyrhizus tuberosus*), and on sugar.

[Report on field crops work in South Australia, 1920-21 and 1921-22], A. J. PERKINS, W. J. SPAFFORD, ET AL. (*So. Aust. Min. Agr. Rpt. 1921*, pp. 8, 9, 11, 12, 28, 29, 30, 31, 32-34, 57; *Jour. Dept. Agr. So. Aust.*, 26 (1922), No. 3, pp. 212-214, 216-218, 220, 222-224).—Besides reports on the progress (E. S. R., 43, p. 528; 44, p. 827; 46, p. 35) of cultural, fertilizer, and rotation tests with wheat, barley, and potatoes, and varietal trials with wheat and potatoes, notes are given on the production of wheat, cereals, cereal hays, sugar beets, and tobacco in South Australia.

Adlay, a new grain plant from the Orient, P. J. WESTER (*Jour. Heredity*, 13 (1922), No. 5, pp. 221-227, figs 6).—A brief discussion of the merits and possibilities of adlay (E. S. R., 47, p. 163).

A genetic analysis of maize, W. C. ETHERIDGE, W. H. EYSTER, and L. J. STADLER (*Missouri Sta. Bul. 197* (1922), p. 69).—Corn plants with zigzag culms were first observed in F₁ progenies of Tom Thumb popcorn × a Missouri dent corn. Crosses between normal plants and zigzag plants gave F₁ with normal culms, which gave some F₂ progenies consisting of normal plants and zigzag plants in the ratio of 15:1, and others 3:1. Evidently two factors designated *Zg zg* and *Z z* were concerned, zigzag culms appearing only when both were recessive. *Zg zg* was very closely, or completely, linked with the factor pair *Gs gs*, green stripe.

The factors for sugary endosperm and tunicate ear were found in the same chromosome about 29 units apart. A comparison of the amount of crossing over between the factors for sugary endosperm and tunicate ear in the formation of pollen and ovules led to conclusions that crossing over occurs about as often in microsporogenesis as in megasporogenesis.

Inheritance of zigzag culms in maize, W. H. EYSTER (*Genetics*, 7 (1922), No. 6, pp. 559-567).—A briefer account of the studies reported is noted above.

The intensity of linkage between the factors for sugary endosperm and for tunicate ears and the relative frequency of their crossing over in microspore and megaspore development, W. H. EYSTER (*Genetics*, 7 (1922), No. 6, pp. 597-601).—This contribution reports in greater detail the work noted above.

The effect of heavy applications of nitrate of soda on the development, yield, and composition of mangels, F. KOROWSKI (*Pum. Państw. Inst. Nauk. Gosp. Wiejsk. Pulawach* (*Mém. Inst. Natl. Polonais Econ. Rurale Pulawy*), 2 (1922), A, No. 1, pp. 99-137, fig. 1).—In experiments near Krakow, Poland, mangels receiving 1,500, 1,000, 500, 250, and 125 kg. of nitrate of soda per hectare (1,335, 890, 445, 222.5, and 111.3 lbs. per acre, respectively) with uniform amounts of potash and superphosphate gave respective yields of 122,800, 70,000, 71,200, 66,300, and 44,300 kg. of roots per hectare and 9,800, 9,000, 10,600, 8,700, and 7,900 kg. of leaves. The respective hectare yields from the

potash and phosphate alone and from the unfertilized plat were 36,600 and 36,000 kg. of roots and 5,800 and 5,000 kg. of leaves.

The largest increases in the weight of leaves took place in July, and in the weight of roots in August and September in all series. The amount of nitrogen taken up from the soil by the plants receiving the smaller amount of nitrate was double that taken up by the plants receiving the two heaviest amounts. The roots showed their ability to convert nitrogen into organic compounds, producing much protein and amids and comparatively little nitrates, in about the proportion of protein, 60 per cent; organic nonprotein, 25 per cent; and nitrate, 15 per cent. Synthesis of protein was observed to be closely associated with insolation, as measured by the heliograph of Campbell. In all treatments much protein was noted in roots and little in leaves in summer, while in the autumn, when insolation is very weak, the reverse was seen. The amounts of potash and soda in the ash seem to depend on the quantity in the fertilizer. Their ratio was the same in the crops as in the fertilizer.

[Experiments with potatoes], J. T. ROSA, JR. (*Missouri Sta. Bul.* 197 (1922), p. 72).—Fertilizer experiments with Irish potatoes indicated that phosphorus was the primary limiting factor. A fairly high percentage of available nitrogen and potash, in addition to phosphates, gave a marked stimulus to the early growth of potato plants. The rate of early growth was correlated with yields.

Standard grades for potatoes, B. B. JONES (*Wis. Dept. Markets Bul.*, 3 (1922), No. 7, pp. 8, figs. 3).—The grades to be used in packing commercial stock include Wisconsin Badger Brand, U. S. No. 1, U. S. No. 1 Small, and U. S. No. 2, the last three being identical with the grades recommended by the U. S. Department of Agriculture (*E. S. R.*, 48, p. 34). Wisconsin Badger Brand is used only for fancy stock. Potatoes not intended to be marketed, as any of these grades can be marketed, but should be designated only as Ungraded. Badger State Brand Certified Seed potatoes applies only to such seed stock as is covered by a certificate of inspection issued by the Wisconsin Experiment Station.

A summary of some experiments conducted with sugar cane by the Bureau of Sugar Experiment Stations since 1902, I–VI, H. T. EASTERBY (*Queensland Agr. Jour.*, 17 (1922), Nos. 5, pp. 219–222, fig. 1; 6, pp. 288–292, fig. 1; 18 (1922), Nos. 2, pp. 75–80; 3, pp. 151–157, fig. 1; 19 (1923), No. 2, pp. 76–78, fig. 1).—The findings in the principal experiments by the Queensland Bureau of Sugar Experiment Stations (*E. S. R.*, 46, p. 836) are summarized.

Decided increases in yields of both cane and sugar from plant cane and ratoons were obtained on alluvial soils by subsoiling, but the practice was not profitable on open, porous, red soils. With both plant cane and first ratoons, irrigation tended to lower the purity of the juice, and on irrigated and non-irrigated plats alike the use of fertilizers increased the tonnage, with a slight reduction in purity of juice. These and other results indicated that at Mackay in normal years with fair rainfall good deep cultivation would give returns equal to those with irrigation.

The slight increase obtained from the use of mixed fertilizers in a very dry season was greatly outweighed by the increase from deep cultivation as compared with ordinary culture. Mixed fertilizers did not cause large gains in plant-crop tonnage after subsoiling, lime, and green manure, whether irrigated or not, but yields from the three ratoons were heavily in favor of the fertilized crops. Nitrogen and potassium gave highest returns, with and without irrigation, in comparisons of single elements on the plant crop, agreeing with soil analyses which showed these elements most needed. Higher yields of cane and sugar were obtained with plant cane and two ratoons from mixed fertilizers than from the separate elements.

Placing sets with three eyes, 6 in. apart or less in the row, was found to be the best method of planting. High yields of cane and sugar were secured with 4-ft. rows, while increasing the distance beyond 5 ft. was indicated as likely to result in low acre yields of cane and sugar. Plantings of cane sets from arrowed cane gave higher yields of cane and sugar than those from nonarrowed cane, and produced nearly as many stalks.

Producing and testing sugar cane seedlings, G. E. L. S[PENCER] (*Jour. Sta. Agron. Guadeloupe*, 1 (1921), No. 4, pp. 113-116; noted in *Internatl. Sugar Jour.*, 24 (1922), No. 286, p. 537).—A description of the methods used at the Guadeloupe Experiment Station.

Statistics on the distribution and production of sugar cane varieties in Java in 1921-22, J. VAN HARREVELD (*Arch. Suikerindus. Nederland. Indië, Meded. Proefsta. Java-Suikerindus.*, 1922, No. 9, pp. 391-412).—Tabulations similar to those of previous years (E. S. R., 46, p. 441) show the distribution and yields of sugar-cane varieties in Java in the season 1921-22. EK 28, the leading variety, was grown on 140,353 acres, or about 39 per cent of the area planted to cane on the island. Other important varieties were DI 52, 247 B, EK 2, 100 POJ, 90 F, SW 3, 2714 POJ, and 2725 POJ, occupying, respectively, 18.5, 17.25, 6.5, 4, 3.25, 2.5, 2, and 1.5 per cent of the total cane acreage.

Sugar formation and ripening in sugar cane, J. KUYPER (*Arch. Suikerindus. Nederland. Indië, Meded. Proefsta. Java-Suikerindus.*, 1922, No. 5, pp. 195-321, figs. 70).—The physiological processes involved in the formation of sugar in sugar cane are treated at length, and a detailed discussion is given of the methods employed in Java to determine the time of maximum maturity.

Since light energy is the principal factor in the production of organic matter, cultivation must be so directed as to render available as much as possible of this energy, which is constant per unit area. The distance between rows and between plants in rows is also touched upon in this connection. Yellow-stripe disease may affect sugar production adversely, since the available light energy can not be fully employed by the infected plants because of the shortage of chlorophyll. Binding tops together to prevent lodging may sometimes cause even more damage than lodging, since it reduces the leaf surface available to light energy.

In observing the progress of the ripening process, samples for analysis, averaging about 20 stalks, are taken systematically in the fields at intervals of from 14 to 20 days. The course of maturation may be judged by the relation between the total solids (Brix) and the quotient of purity in the different parts of the stalk. The glucose ratio apparently changes contrarywise to the percentage of available sugar.

Time of planting and the age of the cane have considerable influence on the ripening process. With favorable climatic conditions the sugar content of fields of different ages may reach about the same maximum percentage, whereas under unfavorable conditions the latest planting will not attain this figure. Differences in this regard existing between moist and dry climates and between several cane varieties are dealt with and illustrated graphically. Maturation progresses most uniformly where the milling season has a minimum rainfall and where the soil moisture is such that the cane may live but with very limited growth.

Hubam clover or annual sweet clover, G. L. SCHUSTER (*Delaware Sta. Bul.* 133 (1922), p. 9).—Observations on Hubam indicated that other crops already in use excel in both yield and quality of hay, and are equal as soil improvers.

Havana cigars and tobacco (*Tobacco*, 75 (1922), No. 5, pp. 19-21, 22-67, figs. 57).—This number comprises considerable information relative to the

production of Havana tobacco in Cuba and the manufacture of cigars and other products. Besides cultural and curing practices obtaining in Cuba, historical notes, classification requirements, and statistics of commerce in leaf tobacco and tobacco products are included.

Effect of various inorganic nitrogen compounds, applied at different stages of growth, on the yield, composition, and quality of wheat. J. DAVIDSON and J. A. LECLERC (*Jour. Agr. Research* [U. S.], 23 (1923), No. 2, pp. 55-68).—The experiments reported supplement previous contributions (E. S. R., 40, p. 244; 47, p. 233) from the Bureau of Chemistry, U. S. D. A.

NaNO_3 , KCl , $\text{Ca}(\text{NO}_3)_2$, $(\text{NH}_4)_2\text{SO}_4$, NaOH , KNO_3 , H_2SO_4 , NH_4Cl , KOH , NH_4NO_3 , NaCl , CaCl_2 , HCl , K_2SO_4 , $\text{Mg}(\text{NO}_3)_2$, MgCl_2 , and HNO_3 were applied in solution to hard winter wheat when about 8 in. high, at heading, and in the milk stage. The applications of the chemicals were calculated at the rate of 320 lbs. of NaNO_3 per acre.

Nitrogen in any of the inorganic forms used, applied at the early stages of growth, was instrumental in producing the highest wheat yields, and when used at the time of heading aided in producing the best quality of grain, as concerns yellow berry and protein content, and also a high protein content in the straw. No relation between the nitrogen content and the weight per 1,000 kernels and weight per bushel of wheat appeared in the experiment. Differences were not observed in the effects of the different forms of inorganic nitrogen. Neither the crop yield nor the grain quality was affected by the chemicals other than the nitrogen carriers.

Nitrogen applied at the first two stages depressed the phosphoric acid content in both grain and straw. This depression is neither considered as a yield relation nor as a reciprocal relation of the two elements in the plant tissues, based on similarity of function. Nitrogen at these growth stages also caused a marked depression of the ash and silica content of the straw.

Self-fertilization and hybridization of wheat. S. LEWICKI (*Pam. Państ. Inst. Nauk. Gosp. Wiejsk. Pulawach* (Mém. Inst. Natl. Polonais Econ. Rurale Pulawy), 2 (1922), A, No. 1, pp. 1-24, fig. 1).—Under conditions in Poland, artificial fertilization by the use of anthers is considered most expedient and productive. Whether pollen or anthers is used, one application is deemed enough. In taking pollen from spikes in the laboratory, the quantity increases with the maturity of the spike, reaching a maximum when the spike is secured at the emergence of the anthers. More pollen is obtained from lax than from compact spikes.

Wheat pollen retains the power of fertilization much longer than rye pollen, as noted by Obermayer (E. S. R., 42, p. 734), giving some fertilization on the day after dehiscence. Pollination of wheat immediately after emasculation or on the second, third, or fourth day after, gave similar results. However, the author obtained the most favorable and uniform results on the fourth day. While artificial fertilization of wheat can be accomplished successfully even at the beginning of spike exertion, the optimum is claimed to be near the end of the exertion period.

Forcing the germination of freshly harvested wheat and other cereals. G. T. HARRINGTON (*Jour. Agr. Research* [U. S.], 23 (1923), No. 2, pp. 79-100).—The fact that newly harvested cereals often do not germinate well at 20° C. (68° F.) or above under ordinary test conditions has caused difficulty in administering State seed laws in the winter-wheat areas where harvesting precedes sowing by only a few weeks and the current crop is used for seed. Artificial drying must be continued for a week or more to be completely effective, and unduly delays the germination test. Attempts to overcome the diffi-

culty are described in this contribution from the Seed-Testing Laboratories, U. S. D. A.

Artificial dry heating, opening the coat structures over the embryo with incidental wounding of the scutella, and cutting off the distal ends were more or less effective in inducing the germination of not after-ripened or partially after-ripened wheat, oats, and barley at room temperature (about 20°-26°). Removal or weakening of the coat structures over the embryos of wheat with sulphuric acid was very effective in inducing complete germination in a minimum length of time. Removal of the scales from oats and barley increased their germination somewhat, and removing the loose pericarp and tegumentary structures over dormant barley embryos caused complete germination. Wounding and corrosion with sulphuric acid are very tedious and entail great danger of subsequent decay.

Presoaking for even one hour in excess of water accelerated the germination of partially after-ripened wheat, oats, and barley but decreased the total germination. Presoaking half an hour in running aerated water did not seem to have any ill effect. No quantitative relation between water content and germinability was noted.

Increasing the oxygen pressure in the atmosphere greatly increased the germination at room temperature of partially after-ripened wheat. The beneficial effects of mechanical treatments and of artificial drying and heating on not after-ripened cereals are probably related to increased oxygen supply to the embryo. The permeability of coat structures to oxygen also probably increases during after-ripening, and the increase is possibly related to the improved germination.

The seed bed for the germination of not after-ripened cereals should supply abundant water available for rapid absorption by the grain without flooding. Somewhat supersaturated absorbent cotton in Petri dishes is satisfactory if the grain is placed lightly on top of the cotton. Barely saturated blotters give equal results if the grain is placed between but not on top of the blotters. A temperature considerably lower than 20° is much more satisfactory than 20° or higher for the germination of freshly harvested wheat, oats, and barley. Wheat responds to the low temperatures more uniformly than oats or barley.

Some samples after-ripen much more quickly than others, suggesting that the rates of after ripening may be varietal characteristics and may be related to winter hardiness under some climatic conditions.

Germination of scarified hard seeds, H. GARMAN (*Seed World*, 12 (1922), No. 8, p. 15).—The number of hard seeds in samples of red clover seed was reduced about 50 and 75 per cent by scarifying for 10 and 20 minutes, respectively, in tests at the Kentucky Experiment Station. Gains of 11.2 per cent in total germination resulted from scarifying for 10 minutes, and 15.8 per cent from treating 20 minutes.

Agricultural seed inspection, J. L. HILLS, C. H. JONES, G. F. ANDERSON, and A. S. LUTMAN (*Vermont Sta. Bul.* 228 (1922), pp. 22-32).—The purity guaranty, percentage of germination, and number of weed seed per pound are tabulated for 319 samples of agricultural seed secured from local dealers in the State during April, 1922.

HORTICULTURE.

[**Horticultural investigations at the Delaware Experiment Station**], L. R. DETJEN (*Delaware Sta. Bul.* 133 (1922), pp. 16-25, figs. 7).—The work herein reported was largely in direct continuation of that of the previous year (E. S. R., 46, p. 639). The examination of the ovules of dropped apples, plums, and

cherries led to the conclusion that at least the later wave of the so-called June drop in pomaceous and drupaceous fruits is not directly due to imperfect pollination. Nitrogen fertilizers continued to show a marked influence on the apple both in relation to production of fruit and to vigor of tree. Varietal differences in response to nitrogen were noted, Jonathan, Stayman, Rome, and Ralls being consistently benefited, while Yellow Transparent varied in behavior. The detrimental effect of crown gall was less evident on well-fertilized apple trees. The fruits of the check trees matured earlier and were brighter colored than those of the fertilized trees, particularly those supplied with nitrogen.

A study of 3,197 cabbage plants derived from 19 selected mother plants revealed a vast multiplicity of types. No success was attained in an attempt to isolate strains homozygous for head type. However, in three instances plant types were isolated to 85.4, 90, and 90.5 per cent of purity. Observations upon some 4,000 cabbage plants produced from seed of plants grown in a glasshouse during the winter of 1921-22 revealed several distinct types, one of which, designated as the Zinnia Rosette, was found to be 100 per cent pure.

A self-compatibility test with 28 cabbage plants indicated marked variation in respect to individuals. On 3 plants less than 1 per cent of pods set seed notwithstanding the fact that hundreds of flowers were produced, 8 plants produced comparatively few and irregular pods, 1 produced a fair set of pods, 3 produced many pods, and 1 plant produced a full set of pods. In all cases the pods from self-fertilized flowers were abnormal, containing only a comparatively small number of seeds. Of 8 plants the flowers of which were cross-fertilized with pollen from similar plants, 6 set 100 per cent of well-filled pods. The other 2, crossed with pollen from plants of the same strain, set only a fair crop of seed. Selfed flowers on 2 of the 6 highly compatible plants yielded only a very few inferior pods.

In spite of the late spring frosts, which seriously affected the general fruit crop in the variety orchards, Wealthy and Ralls apples produced heavy yields. The Jefferson grape suffered but little frost injury. A peculiar witches' broom formation found injuring the Mountain Seedling gooseberry and believed due to the attack of green aphid did not affect any of seven adjacent varieties.

[Horticultural investigations at the Missouri Experiment Station], V. R. GARDNER ET AL. (*Missouri Sta. Bul.* 197 (1922), pp. 72, 73-75).—A progress report for the year ended June 30, 1922 (*E. S. R.*, 46, p. 335), in which various activities are briefly noted, for the most part without including data.

A comparative study in 1921 of dry and liquid lime sulphur for the control of apple scab on apple leaves indicated, under the conditions obtaining in the experiment, that the dry material if used in sufficient quantities is equally effective as the liquid. The addition of miscible oil to the liquid lime sulphur and arsenate of lead mixture apparently increased the effectiveness of the spray as a control for apple scab on the leaves. Chemical study of the wood of apple trees indicated the presence of sulphur in amounts frequently equal to or greater than those of phosphorus. Furthermore, whenever the phosphorus content increased the sulphur decreased, and vice versa.

Studies in strawberry nutrition indicated that, while the nutritive conditions within the soil immediately preceding and during the fruiting season are relatively unimportant in influencing the various plant functions associated with yield, the conditions obtaining immediately preceding and during fruit-bud formation are of great significance.

Practical gardening for pleasure and profit, edited by W. P. WRIGHT (*London: Educational Book Co., Ltd.*, (1922), vols. 1, pp. 367, pls. 5, figs. 293; 2, pp. 365, pls. 2, figs. 329; 3, pp. 367, pls. 3, figs. 375; 4, pp. 359, pls. 5, figs.

358; 5, pp. 360, pls. 5, figs. 336; 6, pp. 376, pls. 6, figs. 209).—A complete guide to plant cultivation and practical gardening.

The South African home garden, edited by G. CARTER (*Martitzburg, [Natal]: Geo. Carter & Co., 1922, pp. 202, figs. 56*).—A practical treatise on various aspects of home gardening in South Africa, with two special articles relating to fungus and insect pests.

Possible cause for variation in yield of check plats in a fertilizer experiment with vegetables, W. C. PELTON (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 227-233).—In order to determine the cause of wide variations in yield of individual check plats in a vegetable project conducted by the Pennsylvania Experiment Station, careful examination was made of the soil in seven pairs of contrasting plats upon which, with the exception of winter cover crops, no fertilizing material of any kind had been applied. Selection of plats was based on the yields recorded from the beginning of the experiment.

A tendency was observed for the most and least productive plats to diverge in yield from year to year, certain of the plats producing no cabbage whatever in 1921, while others produced at the rate of several tons per acre. Examination of the soil to a depth of 3 ft. at two points in each of the plats showed a considerable variation in the depth of surface soil within each area, agreeing within 0.5 in. in only 3 of the 14 plats. The average depth of the surface soil of productive plats was 7.9 in. and of the unproductive 7.8 in., leading the author to believe that the depth of surface soil is not an important factor in the problem. Sharper distinctions were found in the subsoil, in color, in physical nature, and in ease of penetration.

Chemical examination showed that in five of the seven pairs the more productive soils contained a larger amount of humus. In the sixth pair the percentages were equal, and in the seventh the poorer plat contained the greater amount. The greatest range in any one pair was from 1.97 to 1.26 per cent. The results of tests for loss on ignition roughly approximated those for humus content. Soil acidity determinations by the Jones method showed a greater lime requirement in the poorer plats in six of the seven pairs. With the Hopkins method a greater need of lime was shown for all seven of the unproductive plats. The author believes that the presence of either soluble aluminum or iron, substances toxic to many economic plants, is the cause of the principal differences in yield of the plats involved in the present study. It is thought probable that the presence of larger amounts of organic matter in the more productive plats, often due to soil washing from higher levels, has offset the effect of acidity. On the other hand, in certain of the more elevated plats the natural tendency toward acidity has prevented the accumulation of organic matter from crop residues, with a consequent decrease in production.

Pollination studies with cabbage, F. KOŁOWSKI (*Pam. Państ. Inst. Nauk. Gosp. Wiejsk. Pulawach (Mém. Inst. Natl. Polonais Econ. Rurale Pulawy)*, 1 (1920), A, No. 1, pp. 9-23, fig. 1).—Seed pods obtained from bagged flowers of the Amager variety of cabbage were found to be shorter in length and lighter in weight, and to contain a lesser number of seeds, than normally exposed fruits. Determinations of averages gave the following results: Bagged pods, length 58.5 mm., number of seeds 4.5, weight of seeds 22 mg.; normal pods, length 90 mm., number of seeds 19.5, and weight of seeds 110 mg. It was found that some of the selfed plants were much more fruitful than others, leading the author to conclude that marked differences exist in the autogamy of cabbage plants.

The trend of research in pomology, W. H. CHANDLER (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 233-240).—A constructive address reviewing the history of pomological research during the past few years, pointing out the

conspicuous successes and failures, and discussing means and methods for improvement in the future.

It is pointed out that field experiments have failed in many cases because of lack of careful foresight and planning and failure to observe the multiplicity of environmental factors capable of influencing the results. It is suggested that such problems in the future should be more limited in scope and that orchards for experimental purposes should be planted under the most uniform conditions possible, with records taken from the very beginning so that accurate knowledge may be available relative to the behavior of the trees prior to the introduction of the actual experimental treatments. Field studies should be accompanied by physiological and chemical investigations, which, in the opinion of the author, may be often best performed by the investigator himself, who should be sufficiently trained to carry on all the phases of a single problem.

Biochemical problems in agriculture with special reference to fruits, A. F. BARRS (*Sci. Agr.*, 3 (1922), No. 3, pp. 100-104, figs. 2).—A general discussion emphasizing the value of fundamental research to the fruit grower, and pointing out the need of further studies on the nature of hardiness and disease resistance in plants, on the causes of sterility in fruits, and on the changes occurring in stored fruits, vegetables, etc.

Two new varieties of blight-proof apple, C. F. COLE (*Jour. Dept. Agr. Victoria*, 20 (1922), No. 8, pp. 491-493, figs. 2).—The Boswell and Cole, Australian apples of proved resistance to woolly aphis, are described in detail. Both fruits are supposed to contain Jonathan parentage.

Comparative cropping of apple trees propagated from parent trees of good history and bad history, A. N. RAWES (*Jour. Roy. Hort. Soc.*, 47 (1922), No. 2-3, pp. 163-168, figs. 3).—In this preliminary report from the Wisley Laboratory upon bud selection studies begun in 1913 with the object of ascertaining the possibility of transmitting yield in the vegetative reproduction of the apple, evidence is presented to show that peculiarities in productive capacity of the parents are not transmitted to the progeny. Buds and scions from vigorous comparable trees of known performance were worked on stocks previously selected for uniformity in character and vigor but, unfortunately, not of a single clonal variety. Four varieties, Cox Pomona, Ecklinville Seedling, Oldenburgh, and Egremont Russet, were included in the investigations.

Records of the number of fruits produced by the trees from high and low yielding parents showed wide variation between the individuals in both groups. However, the average yields in the contrasting groups were in all cases approximately equal. In the case of Egremont Russet on crab stock the production of the individuals in the high yielding progeny ranged from 158 to 0 fruits, with an average of 78. In the low yielding progeny the range was from 184 to 2, with an average of 76. With Egremont Russet on dwarfing stocks the high yielding trees averaged 82 and the low yielding 78. In the case of Oldenburgh on dwarfing stocks the high yielders averaged 74 and the low yielders 74. Disease interfered with accurate interpretation of results in the Ecklinville Seedling variety. None of the peculiarities in fruiting habits of the parents were observed in the progeny, and the quality of the fruit of the two opposing groups was in no wise different, many good and many indifferent fruits being produced in both groups.

The author concludes, therefore, that differences in productivity existing between comparable trees of a given apple variety are not transmissible through the medium of asexual propagation. The differences between individual trees are deemed to be due not to heredity but to acquired and fluctuating characters traceable to variations in environment and in stocks.

Winter pruning experiments with apple trees, N. H. GRUBB (*Jour. Roy. Hort. Soc.*, 47 (1922), No. 2-3, pp. 159-162, pls. 16).—This is a well illustrated report from the East Malling Research Station upon the behavior of apple trees submitted to various winter pruning treatments.

The trees, planted in the winters of 1913-14 and 1914-15, were cut to 2-ft. heights and for the first two winters were submitted to severe formative pruning. While deploring the fact that the trees were originally grafted on mixed Paradise stocks, the author states that identification of the roots is proceeding at the present time by examination of root suckers. The varieties were interplanted so as to obtain equable and adequate interpollination. Four types of pruning were compared, namely, (1) no pruning with the exception of removing diseased and broken branches, (2) open center and more or less bowl shaped, (3) tipped and long-spurred with leaders shortened from one-third to two-thirds and all laterals not needed to form branches spurred to three prominent buds, and (4) tipped and short-spurred, leaders shortened as in (3) and laterals spurred to one prominent bud. Finding the original plan of removing two-thirds of the leaders of weak-growing varieties too drastic a treatment, the length was modified to one-half; otherwise the program was carried through as nearly as possible according to the original project.

Observations at the blooming period showed clearly that tipping and spurring had not only reduced the number of blossoms but also delayed their formation. A tabulation of the average number of blossom buds per tree for unpruned and for long spur pruned trees of several varieties in 1920 and 1921 showed that in only one instance, that of Newton Wonder in 1921, did the pruned trees surpass the unpruned in number of blooms. This exception was accounted for by an unusually heavy set of fruit on the unpruned trees of this variety in the preceding year. The pruned trees, with the exception of those of the Worcester variety, matured nearly double the percentage of fruits in 1921 in relation to the number of blossom buds as did the unpruned trees. Observations made upon five different varieties in 1921 indicated that the increased set of fruit on the long-spur pruned trees was correlated with a greater percentage of fruit clusters in four of the five varieties.

The total number of fruits produced during the three years 1919-1921 was, with the exception of the two varieties Newton Wonder and Beauty of Bath, reduced by the tipping and spurring. In the case of Beauty of Bath this deviation is explained by the fact that the trees had as yet never produced a moderate sized crop. Since the leaders on the Newton Wonder and Beauty of Bath trees were shortened only one-third, it is thought possible that if the other varieties had been similarly treated they might have behaved in a like manner. The pruned Newton Wonder trees commenced fruiting at 5 years of age; therefore it is deemed probable that they had become more nearly adjusted to pruning treatment than had the later bearing sorts. Newton Wonder and Beauty of Bath likewise bore a greater yield of fruit on pruned trees; the differences, however, were not as marked as in number of fruits. On Newton Wonder the individual weight of fruits on pruned trees was 4.5 oz., as compared with less than 3 oz. for the unpruned trees.

Indications were noted that systematic pruning had a tendency to correct biennial bearing. Two early Victoria trees, one unpruned and the other open centered, alternated in producing heavy crops. In contrast to the unpruned, the long-spurred Newton Wonder trees produced a greater crop in 1921 than in 1920. Individual records taken upon eight long-spurred Newton Wonder trees indicated that the number of blossoms present had a greater limiting effect upon the formation of next season's fruit buds than did the number of fruit.

In discussing the effect of pruning on growth and ultimate development of the trees, the author reports that his results, conforming in general with those of Pickering (*E. S. R.*, 35, p. 87), show that heavy cropping of unpruned trees inhibited growth so that pruned trees were able to overtake and in many cases surpass the unpruned. Evidence was obtained, however, to show that certain varieties do not conform to this rule. Shortening of leaders had a variable effect on the production of lateral shoots and in one variety, Allington, forced the production of an excessive number of lateral growths.

The lesser amount of apple scab, mildew, and canker found on pruned trees is believed to be due to the greater resistance developed in the vigorous growing wood of long-spur pruned trees.

The differences between unpruned and open-center treatments were in some cases significant. More fruits were borne in clusters on the open-centered trees. The average number of fruits was less than that of the unpruned trees, but the average total weight was slightly greater. The individual fruits from the open-centered Newton Wonder trees averaged nearly 40 per cent heavier than those from the unpruned trees. In five varieties worked on both crab and Paradise stocks, the larger trees were found in the crab group, and in four of the five varieties the unpruned and the open-centered trees on crab roots have yielded the larger number of fruits. In the case of two varieties, Allington and Newton Wonder, the open-centered trees are more regular in bearing than unpruned trees, the latter usually showing a positive inclination to biennial fruiting. The most conspicuous difference between the short and long spur methods of pruning was in the number of blossoms, the short-spur trees, with two exceptions, developing a much lesser number. In certain varieties the short spurs died outright, leaving a considerable length of spurless, unproductive wood. The author, emphasizing the striking differences in habits of growth and of bearing in relation to variety, classified the varieties discussed in the paper into groups according to their habit of growth.

Picking, packing, and loading apples in bushel baskets and barrels, F. H. BEACH (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 11-12, pp. 197-200). This is a presentation of practical information.

Nitrate of soda tests on bearing peach trees (*South Carolina Sta. Rpt.* 1922, pp. 46, 47, figs. 2).—A single season's test of the effect of various amounts of nitrate of soda on 7-year-old peach trees indicated that under the conditions obtaining in the experiment applications of 2 lbs. of nitrate of soda per tree are not sufficiently large to benefit the trees. Applications of 4, 5, and 6 lbs., on the other hand, produced good growth, healthy foliage, and abundant fruit-bud formation. Studies in time of application were in favor of early spring, although satisfactory results were secured when half the nitrate was applied at the time the fruits were half grown. Fruits on the treated plats ripened several days later and in most cases exceeded in size those of the check trees.

Improved method of propagating the litchi, B. T. GALLOWAY (*Jour. Heredity*, 13 (1922), No. 5, pp. 201-206, figs. 5).—A descriptive account relating to an apparatus the use of which has assisted in the successful propagation of the litchi.

Note on the pineapple growing in Mexico, J. BALME (*Rev. Agr. [Mex.]*, 6 (1921), No. 3, pp. 147-151, figs. 5; *abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr.*, 12 (1921), No. 12, pp. 1554, 1555).—General information is given relative to geographical distribution, soil and cultural requirements, and varieties.

Fritz Bahr's commercial floriculture; a practical manual for the retail grower, F. BAHR (*New York: A. T. De La Mare Co., Inc.*, 1922, pp. 559, figs. 288).—A popular text designed for the assistance of the practical grower.

Scented roses, E. J. HOLLAND (*Jour. Roy. Hort. Soc.*, 47 (1922), No. 2-3, pp. 122-132).—In tracing the development of the modern hybrid tea rose, the author points out the principal sources of fragrance and classifies many popular varieties in respect to the presence or absence of odor.

FORESTRY.

Economic aspects of our timber supply, W. B. GREELEY (*Jour. Forestry*, 20 (1922), No. 8, pp. 837-847).—A broad outlook upon the forest problems of the United States, in which the author, after pointing out the rapid diminution of the original forests and the westward movement of the sources of supply, emphasizes the important rôle that transportation plays in regulating the retail price of lumber. Reforestation of idle lands, already begun in the Northeastern States, is believed by the author to be the one measure capable of preventing serious disaster in the future. The vast timber supplies in Siberia, open to the competition of the world, may very well command prohibitive prices, and can not, therefore, be seriously considered as assured reserves.

[Report of the] mission for the study of forest conditions sent to the French Colonies by the ministries of war, armament, and the colonies.—**V. The forests of French Guiana and Brazil**, A. BERLIN ET AL. (*Mission d'Études Forestières Envoyée dans les Colonies Françaises par les Ministères de la Guerre, de l'Armement, et des Colonies*.—V. *Les Bois de la Guyane Française et du Brésil*. Paris: Gort., 1920, vol. 5, pp. 191+321, pls. 2, pgs. 27).—This report presents information collected by the mission detailed by the French Government to survey the forest resources of French Guiana with a view to ascertaining the possibility of utilizing timber therefrom in reconstruction work in France. It was found that the colony is practically covered with a dense forest consisting of a mixture of a large number of species, the trees of which are unusually tall but with comparatively small trunks. The various species are discussed in detail in relation to botanical characters, ease of working the wood, and possible uses. Plans of exploiting the forest resources of various colonies, including French Guiana, are presented. Information is also given relative to the forest species of Brazil.

A suggestion for forest regions and forest types as a basis of management in New York State, H. C. BELYEA (*Jour. Forestry*, 20 (1922), No. 8, pp. 854-868, fig. 1).—With a view to shaping an intelligent forest policy for the State of New York, the author divides the State into seven distinct forest areas designated as follows: (1) The central wood-lot region, (2) Tug Hill region, (3) northern Appalachian region, (4) Adirondack forest region, (5) northern hardwood region, (6) sprout hardwood region, and (7) the Catskill forest region, and discusses the forest types characteristic of each division.

Success in prairie tree planting, N. M. ROSS (*Canada Dept. Int., Forestry Branch Bul.* 72 (1922), pp. 34, figs. 20).—This paper relates to the establishment of shelter-belt plantations on the Canadian prairies.

Of various broad-leaved species tested, the Manitoba maple, green ash, caragana, Russian poplar, and Russian willow were especially successful. The Russian poplar, although the fastest growing species and hardy in all parts of the Canadian West, was, unfortunately, attacked by a trunk-injuring fungus and is, therefore, recommended for planting only in a limited way. The Manitoba maple is considered the best all-round species. It is recommended that each shelter belt include one or two rows of hardy evergreens, for which purpose the native white spruce, jack pine, lodgepole pine, and certain hardy strains of Scotch pine have proved satisfactory. The evergreens, although

growing slowly at first, surpass in later years the broad-leaved species. The average of thousands of height measurements taken upon 20-year-old trees planted 4 by 4 ft. at the Indian Head Nursery, Saskatchewan, are as follows: Russian poplar 35 ft., white birch 24, maple 22, ash 20, elm 17, Siberian larch 29, American larch or tamarack 24.5, Scotch pine 21, jack pine 20, lodgepole pine 18, and white spruce 17.5 ft.

The transect of a mountain valley, C. G. BATES (*Ecology*, 4 (1923), No. 1, pp. 54-62, figs. 3).—Evaporation, soil temperature, and soil moisture records taken at stations located 50 ft. apart on a north-south line cutting across a mountain valley located near the Fremont Experiment Station, Colorado, indicated that the direction of the slope has a very marked influence on environmental factors. In the valley studied the southern exposure is covered with western yellow pine, beginning to be invaded by Douglas fir. The base of the northern exposure is clothed with a dense stand of Engelmann spruce, above which is a forest of Douglas fir extending to the tip of the ridge.

Because of the fact that the southern exposure is subject to direct sunlight, very high soil temperatures occur during summer. For example, in 1921 there was recorded a maximum soil temperature of 150° F., a degree which is believed sufficient to kill seedlings. In addition, the surface soil of the southern exposure quickly lost moisture and at times dropped below the wilting coefficient, thus preventing germination and destroying all seedlings except those with long roots.

It is believed that the prompt germination and immediate deep rooting character of the yellow pine has enabled this species to occupy the warm southern site. Douglas fir, on the other hand, although possessing the rapid germination and deep rooting qualities of the yellow pine, is apparently less heat resistant and is, therefore, unable to invade southern exposures except under the protection of other vegetation. The lowest evaporation, lowest soil temperature, greatest accumulation of summer moisture, and most gradual drying of soil occurred on the lowest and also the steepest sections of the northern exposure, that area densely covered with Engelmann spruce. In discussing two possible causes (1) cold and lack of sunlight and (2) unfavorable character of soil, the author believes that the second is responsible for the almost complete absence of Douglas fir on the lower part of the northern exposure. Further up the northern exposure Douglas fir apparently found more favorable conditions, yet it was noted that on similar sites there is a marked tendency for Engelmann spruce to invade and supersede the fir once the latter has been fully established.

Association of trees, shrubs, and other vegetation in the northern Idaho forests, J. A. LARSEN (*Ecology*, 4 (1923), No. 1, pp. 63-67).—Based on collections made at the Priest River Forest Experiment Station (U. S. D. A. Forest Service), plant associations are given in tabular form for three characteristic forest types, namely, (1) western yellow pine, (2) western larch-Douglas fir, and (3) white pine, cedar, hemlock, and lowland white fir forests. The lists are compiled with a view to including the more frequent and typical plants and not the complete flora. No records of comparative frequency are given.

Birch succession in sphagnum bogs, G. B. RICE (*Jour. Forestry*, 20 (1922), No. 8, pp. 848-850).—The discovery of western birch (*Betula occidentalis*) in several bogs in the western part of Whatcom County, Wash., leads the author to conclude that this species is fairly characteristic of sphagnum bogs in that region. Furthermore, it is believed that the species has a tendency to occupy

such areas in their later stages of succession. Drainage and possibly burning or clearing are believed to favor the introduction of the tree.

Cutting methods in Norway pine, T. S. HANSEN (*Jour. Forestry*, 20 (1922), No. 8, pp. 851-853).—A study of a small plot of Norway pine located in Lake County, Minn., and consisting in part of the original stand, 150 years old, leads the author to believe that Norway pine should be removed in two cuttings, the first very light, about 20 per cent, and the second completing the operation, some 10 years later. Ample reproduction will occur in the partially thinned stand to insure adequate restocking of the area after the final cutting. It is recommended that slash be not burned except where the fire hazard is great, and then only in compact piles when the ground is covered with snow. Without burning, the composition of the new stand will be predominately Norway pine to the exclusion of birch, poplar, balsam, and other inferior species which ordinarily follow burning operations.

DISEASES OF PLANTS.

[Report of the] department of plant pathology, T. F. MANNS and J. F. ADAMS (*Delaware Sta. Bul.* 133 (1922), pp. 26-33).—Reports are given of various investigations carried on at the station.

In a study on the causal organism of pox of sweet potatoes the authors report finding *Rhizoctonia* very commonly associated with the disease both in the field and in the greenhouse. Laboratory studies were undertaken to determine the presence of *Cystospora batata* reported by Elliott as the cause of this disease of sweet potato (*E. S. R.*, 36, p. 544). All the studies failed to disclose the above species, but culture work showed the presence of *Rhizoctonia*, *Sphaeronema*, and *Fusarium*. Centrifuge studies made of pox-sick land showed the presence of sclerotial bodies similar to the *Rhizoctonia* secured in cultures.

Continued studies have been made on the cause of peach yellows and little peach, and the authors have been unable to bring about infection by using the sap or juice crushed from plants affected with either disease. It was thought possible that pollen might serve as a carrier of these diseases, and a large number of pollinations were made using pollen from diseased trees, with the result that no fruit set from blossoms pollinated with pollen from such sources.

A brief report is given of a study of brown rot of peach, particularly relating to the possibility of cankers resulting from blossom blight being the means of carrying the fungus over winter. Several varieties of peaches were studied, and it was found that 75 per cent of the cankers on Carmen trees carried the brown rot fungus over winter, while there was no evidence of the organism overwintering in this manner in cankers on the varieties Belle and Elberta. Dormant twigs from Carmen trees containing cankers were dipped in a 4-4-50 Bordeaux mixture, and after drying for 24 hours the fungus pushed through the fungicide and produced abundant conidia.

Notes are given on the occurrence of various diseases of cucurbits, and an account is presented of field experiments for the control of the fungi, together with insect pests. Spraying with Bordeaux mixture to which lead arsenate was added was carried on at two localities, and dusting with a powdered fungicide consisting of copper sulphate, lead arsenate, and nicotin sulphate was undertaken to secure comparative data. Both treatments were effective in controlling diseases and insect pests on cantaloupes.

Studies were undertaken with *Rhizoctonia*, *Pythium*, and *Fusarium* which are said to have caused considerable loss to canning peas, but the crop proved a failure due to a dry season and severe attacks of aphids. Some experimental work on the control of aphids is briefly reported, in which it is shown that

dusting with nicotin sulphate when the terminal leaflets were open resulted in 95 per cent control of the insect pest. When the terminal leaflets were closed the control was less than 10 per cent.

On account of the increasing importance of cowpeas and soy beans in the State, a study was made of the diseases of these crops, and cowpeas were observed to be subject to leaf spot due to *Amyrosporium oeconomitum* and *Cercospora cruenta*, a sun scorch which is not parasitic, and a pod spot which is not determined. Soy beans were found to be subject to a chlorosis that is probably not parasitic, and a bacterial leaf spot.

In cooperation with the Crop Production Institute, experiments were carried on for the control of oat smut, copper sulphate dip, formaldehyde sprinkling, formaldehyde spray, copper carbonate dust, and dehydrated copper sulphate and lime dust being compared. No smut was observed on those plats the seed for which was treated with either of the formaldehyde treatments, and only traces of smut where the seed was dipped in the copper sulphate solution or where copper carbonate dust was employed. Dehydrated copper sulphate was not found to control oat smut as well as any of the other treatments.

[Report of the department of] soil bacteriology, T. F. MANNS (*Delaware Sta. Bul. 133 (1922), pp. 35, 36*).—Studies are reported on the possibility of detrimental organisms being introduced into rotations through the use of infected seed corn. Examinations made of complete cultures from soils where corn root rot had been abundant showed neither *Gibberella saubinetii* nor *Diplodia zeae*, but they frequently gave *Fusarium moniliforme* and a species of *Cephalosporium*, which is tentatively assigned to the species *C. sacchari*. It is claimed that corn root rot is greatly aggravated by unfavorable conditions such as poor drainage, excess rains, drought, etc., under which conditions several pathogenic organisms gain entrance to roots and nodes and make rapid growth.

Further studies are said to show that sweet corn is more subject to internal infection with parasitic organisms than is field corn, and this is said to be especially true with *F. moniliforme*.

Studies made of white varieties of Sussex field corn which showed pink colorations of crowns showed this condition to be associated with *F. moniliforme*.

The crop disease situation in 1921. A. V. OSMUN (*Massachusetts Sta. Rpt. 1921, pp. 62a-75a*).—During the year 1921 the author reports three important epidemics of plant diseases in Massachusetts. These were the apple scab fungus (*Venturia inaequalis*), tobacco wildfire (*Bacterium tabacum*), and downy mildew of cucumbers and melons caused by *Pseudoperonospora cubensis*.

Lists are given of other plant diseases observed during the year.

[Report of the department of] botany (*Missouri Sta. Bul. 197 (1922), pp. 48, 49*).—In continuing the study of excised corn root tips (*E. S. R., 46, p. 323*), W. J. Robbins and W. E. Maneval found that autolyzed yeast and light were both beneficial factors in the growth of excised corn root tips in Pfeffer solution under sterile conditions. Temperature was also an important factor, and in the light a temperature of about 28° C. (82.4° F.) or above was detrimental to root growth.

E. F. Hopkins, as a result of studies of wheat scab (*Gibberella saubinetii*), gives a formula for determining the relation of H-ion concentration and the number of conidia produced per square centimeter of colony surface. It is reported that extraction of the indicator pigment produced by *G. saubinetii* has been successful, and an attempt is being made to determine its composition and indicator properties. From a study of resistance of wheat to scab a consider-

able number of rod rows were sown, and seven varieties were found to be free from scab in all the tests.

The relation of H-ion concentration to the growth of the organism of tomato wilt (*Fusarium lycopersici*) has been determined by I. T. Scott. A maximum in the growth curve was observed at about pH 4 to 4.5, and a minimum at about pH 5.5.

A survey of seed corn in different parts of the State to determine the amount of infection by corn root rot was made by B. B. Branstetter, and only a few ears were found to be free from disease organisms. The organisms present in order of their prevalence were: *F. moniliforme*, *Cephalosporium sacchari*, *Diplodia zeae*, and *G. saubinetii*.

Field tests are said to have shown that the amount of root and stalk rot in the field was correlated with the amount of infection in the seed as shown by table germinations.

The occurrence of protozoa in plants affected with mosaic and related diseases, R. NELSON (*Michigan Sta. Tech. Bul.* 58 (1922), pp. 3-30, figs. 18).-- Adopting methods used by protozoologists, the author made a study of the mosaic diseases of bean, clover, tomato, and potato and found definite protozoan organisms constantly associated with these diseases. The organisms were observed mainly in the sieve tubes and sieve parenchyma, and as they lie in a plane parallel to the longer axis they can be demonstrated only in longitudinal sections. The organism associated with bean and clover mosaic is said to be a biflagellate elongated protozoan whose generic position is near *Leptomonas*.

The organisms found in mosaic tomato plants are apparently trypanosomes, or are closely related to this genus, while those observed in the sieve tubes of potato leaf-roll plants are said to more closely resemble trypanosomes than any other form.

Tolerance to acids of certain bacterial plant pathogens, F. A. WOLF and I. V. SHUNK (*Phytopathology*, 11 (1921), No. 6, pp. 244-250).--Cultural studies have been made on the tolerance to acids of various plant pathogenic bacteria, including the cabbage black rot organism, one commonly causing decay of root crops, two causing soy bean leaf spots, and two causing tobacco leaf spots. Different acids of the same H-ion concentration exert different influences in inhibiting cell multiplication, acetic acid being more toxic than the others employed. To inhibit growth a greater pH concentration is required in agar than in bouillon, this difference ranging between 0.2 and 0.4 pH with the same organism and the same acid.

Two new *Sclerotinia* diseases, B. F. DANA (*Phytopathology*, 11 (1921), No. 5, pp. 225-228, pl. 1).--The *Sclerotinia* disease of *Amelanchier canadensis* due to *S. gregaria* n. sp., and noted previously (*E. S. R.*, 48, p. 143) is technically and otherwise described as studied on the campus of the Washington College and in the vicinity of Pullman.

A disease of *Prunus demissa* was studied along with the similar disease on *Amelanchier*, and this is described as due to *S. demissa* n. sp.

The reaction of the F₂ generation of a cross between a common and a durum wheat to two biologic forms of *Puccinia graminis*, G. F. PUTTICK (*Phytopathology*, 11 (1921), No. 5, pp. 205-213).--A study was made of the parasitic capabilities of two biologic forms of *P. graminis* on the F₂ generation from a cross between Marquis (*Triticum vulgare*) and Mindum (*T. durum*). It was found that the parental plants react reciprocally to the biologic forms used. The parasitic capabilities of these forms having previously been studied carefully, their action is known to have been constant. Form 1 attacked Marquis normally but developed weakly on Mindum. Form 19 attacked Mindum heavily but developed weakly on Marquis.

Each F_2 plant was inoculated with both biologic forms of rust. The plants were inoculated with Form 19 when they were about 8 days old. Seedling plants were infected easily, and older plants with more difficulty, this being attributed not to increased resistance but to the fact that older plants retained a film of moisture less easily than seedlings.

All gradations between complete susceptibility and immunity to both forms of rust appeared in the F_2 plants. There was some evidence that a single main pair of genetic factors was responsible for the manner of reaction to Form 19. If this is true, modifying factors must be present, and these would account for the various grades of infection obtained. Infection results with Form 1 were not very satisfactory, and no evidence was obtained that a single main pair of genetic factors may explain the manner of reaction to this form.

All combinations of susceptibility and resistance of individual F_2 plants to the two biologic forms appeared in these tests. Of 388 plants, 35 were highly resistant to both forms, and from this it is assumed that varieties resistant to more than two biologic forms may be produced by hybridization. This fact, together with the demonstrated relative constancy of biologic forms, gives additional assurance that varieties of wheat which will be commercially resistant over fairly extensive crop areas can eventually be produced.

Biologic forms of wheat stem rust in western Canada, W. P. FRASER and D. L. BAILEY (*Abs. in Phytopathology*, 11 (1921), No. 4, p. 202).—By greenhouse experiments in 1919 four distinct forms of stem rust were found to occur in wheat in western Canada. One of these was more common and widely distributed than the others. There were indications of several other biologic forms on wheat in the same region. All of the forms separated were identical with those found by Stakman and his coworkers to exist in the United States.

Biologic forms of wheat stem rust in western Canada, M. NEWTON (*Abs. in Phytopathology*, 11 (1921), No. 4, p. 202).—At least five biologic forms of wheat stem rust have been shown to be present in western Canada. These forms were found to be identical with five of the strains of rust previously isolated in the United States by Stakman. A rather virulent strain was quite widely distributed, being found in eight different localities of central Saskatchewan and eastern Alberta.

Experiments with Haskell's method or the so-called dry formaldehyde treatment for the prevention of oat smut, J. E. HOWITT (*Abs. in Phytopathology*, 11 (1921), No. 4, p. 203).—The dry formaldehyde treatment for oat smut has been tested for 3 successive years by the department of botany at the Ontario Agricultural College, 28 field trials under ordinary farm conditions having been made and 1,677 bu. of oats treated by this method.

The results have been uniformly satisfactory, as no injury to the grain resulted, and smut control has been practically perfect, untreated check fields showing an average of 5.8 per cent of smut. The advantages of this method over those previously employed locally are simplicity, rapidity, and ease of application. By this method 100 bu. of oats could be treated in 50 minutes. No time was lost waiting for the seed to dry. There was no sprouting or molding or swelling of the grain.

Use of copper soap dust as a fungicide, F. J. PRITCHARD and W. S. PORTE (*Phytopathology*, 11 (1921), No. 6, pp. 229-235).—Copper soap dust, a new fungicide prepared from copper sulphate and fish-oil soap, has for two years at the Arlington Experimental Farm given as good control of tomato leaf spot (*Septoria lycopersici*) as has the 4-4-50 liquid Bordeaux mixture. It is said that this dust preparation spreads, floats, and adheres better than Sanders Bordeaux dust, and in these experiments it gave better control of tomato leaf spot. Being much more effective pound for pound, it will probably cost no more

per acre. It is cheaper than liquid Bordeaux, considering the greater ease and rapidity of application. Because of its excellent chemical, physical, and fungicidal properties, it offers promising possibilities for the control of a large number of other foliage diseases.

The cooperative potato spraying project: Progress report for 1918, 1919, and 1920. G. R. BISBY (*Phytopathology*, 11 (1921), No. 4, pp. 178-193, fig. 1).—The author, as leader since 1918, reports in considerable detail on this project, one of the problems for cooperative work undertaken by the American plant pathologists under the auspices of their War Emergency Board and Advisory Board. The history and plans of the project are briefly outlined, with a summary of results and status of the use of Bordeaux mixture on potatoes in Canada and this country.

It appears that Bordeaux mixture is necessary to control late blight in the Maritime Provinces, in Quebec, in northern New England, and in New York. Increased yields are general in the absence of late blight. This disease is less common in Ontario, Rhode Island, Connecticut, New Jersey, Delaware, Pennsylvania, Ohio, Michigan, Wisconsin, Minnesota, and Florida. Careful spraying is profitable in certain areas indicated, and generally in any region in years in which late blight is serious.

Copper dust appears valuable, as indicated by the Canada and New York reports. Burgundy mixture scarcely equaled Bordeaux in Canada.

It is evident that knowledge of the value of Bordeaux mixture on potatoes is still very incomplete. Tests of this and other compounds are needed in many parts of North America to determine their value under various conditions, and there is excellent opportunity for spraying in cooperation with entomologists.

Tobacco diseases in Gadsden County in 1922, with suggestions for their prevention and control. W. B. TISDALE (*Florida Sta. Bul.* 166 (1922), pp. 72-118, figs. 15).—Illustrated descriptions are given of tobacco diseases observed in Gadsden County, Fla., in 1922. In this region tobacco is largely grown under shade as a continuous culture crop. The following diseases are treated, and suggestions are given for their prevention and control: Mosaic disease, root knot (*Heterodera radiculicola*), wildfire (*Bacterium tabacum*) Granville wilt (*B. solanacearum*), leaf spot (*Phyllosticta nicotianae*), frog-eye or specking (*Cercospora nicotianae*), root rot (*Thielavia basicola*), and black shank (*Phytophthora nicotianae*).

Studies on the Valsa apple canker in New Mexico. L. H. LEONIAN (*Phytopathology*, 11 (1921), No. 6, pp. 236-243).—A great number of apple trees throughout New Mexico were found to be badly affected with a canker caused by *V. leucostoma*, twigs, branches, limbs, and trunks being impartially attacked. Both the imperfect and the perfect stages of the organism responsible for the canker were reproduced in artificial media. Sodium chlorid and cane sugar, under proper conditions, acted as stimuli to form perithecia on oatmeal agar. Inoculation experiments showed the fungus to be a weak wound parasite.

Control of cherry leaf spot (*South Carolina Sta. Rpt.* 1922, p. 49).—Excellent results are said to have been obtained in the control of leaf spot on eight varieties of cherries by spraying them with a 2.5-4-50 Bordeaux mixture, the first application being made immediately after the petals had fallen, the second three weeks later, and the third directly after the picking of the fruit.

Leaf scorch or mollisiose of the strawberry. R. E. STONE (*Abstr. in Phytopathology*, 11 (1921), No. 4, pp. 202, 203).—Leaf scorch is a recently recognized disease of strawberries in Ontario. It is widely distributed, extending from

Sarnia in the western part of southern Ontario to Ottawa in the eastern part. The leaves present a scorched or blotched appearance and all the leaves on the plant may be killed, so that entire strawberry patches may look as if burned over. In the summer the blotches show the fungus *Marsonia potentillae*. This conidial stage may persist over winter on green leaves and to a certain extent on the dead leaves, which develop an ascigerous stage identified as *Mollisia earliana*. Ascospores from this fungus infect the leaves of strawberry plants and produce typical leaf scorch. Ascospores planted in nutrient agar-agar developed Marsonia, which produced the typical disease when sprayed on strawberry plants.

The conclusion was reached that *Mollisia earliana* is the perfect stage of *Marsonia potentillae*, and the disease produced has been named according to the method of Stevens. Different varieties of strawberries are not equally susceptible, the order among those observed appearing to be Clyde, Glen Mary, Senator Dunlop, Haverland, and New Williams. Control suggestions include clean cultivation, destruction of old foliage, and early spraying with Bordeaux mixture.

Citrus scab: Its cause and control, J. R. WINSTON (*U. S. Dept. Agr. Bul. 1118* (1923), pp. 39, pls. 16, figs. 6).—Citrus scab is thought to be an important disease of foreign introduction, attacking many species of citrus trees. It is said to be found in the citrus-growing regions of the Gulf States and in many other countries, but it has not yet become established in California and Arizona.

In the orchard the activity of the disease is mainly confined to fruit and leaves. Leaves are most susceptible in the early stages of growth, and they become entirely resistant by the time they reach 0.5 in. in width. Young grapefruits are said to be extremely susceptible immediately after the falling of the petals, but they become immune after obtaining a diameter of about 0.75 in. Scab infection is said to be possible whenever there is sufficient moisture at the time the parts are in a susceptible stage.

The cause of citrus scab is found to be not due to the fungus *Cladosporium citri*, as frequently referred to, that organism being a common saprophyte in citrus lesions. The identity of the causal organism has not been definitely determined.

Cumulative evidence is said to show that citrus scab can be controlled satisfactorily and economically by the use of Bordeaux mixture, or Bordeaux mixture to which oil emulsion is added. Lime sulphur is less effective than Bordeaux mixture, and other sulphur sprays are no more effective than lime-sulphur solution.

Note on *Cenangium abietis* on *Pinus ponderosa*, J. R. WEIR (*Phytopathology*, 11 (1921), No. 4, pp. 166-170, figs. 2).—*C. abietis*, the cause of a serious disease on pines in Europe, is reported for the first time in the western United States on *P. ponderosa*. Experiments demonstrate the apparent parasitism of the fungus, a condition not heretofore reported in America.

Cenangium piniphilum* n. sp., an undescribed canker-forming fungus on *Pinus ponderosa* and *P. contorta, J. R. WEIR (*Phytopathology*, 11 (1921), No. 7, pp. 294-296, pl. 1, figs. 2).—The species described was first collected at Boulder, Mont., on *P. contorta*, on June 8, 1915. Since that time it has been found abundantly in the lake region of northern Idaho attacking *P. ponderosa* and *P. contorta*. It is here described as *C. piniphilum*.

This fungus, which is of considerable silvicultural significance, attacks *P. ponderosa* and *P. contorta* between the ages of 5 and 25 years. Infection usually occurs at the branch whorls, suggesting a natural weakness at this point. Wounds are, however, a source of infection. Such infections as occur

at the base of branches spread to the main trunk, frequently involving the entire circumference at this point. Although the fungus grows readily on artificial media, it has not yet been induced to form apothecia. The mycelium on artificial media breaks up into conidia, a condition not observed in nature.

Investigations of *Cronartium ribicola* in 1920, L. H. PENNINGTON ET AL. (*Phytopathology*, 11 (1921), No. 4, pp. 170-172).—In the Adirondacks, Pennington found, among other facts, that aeciospores were produced in greater abundance and were more widely distributed than in the seasons of 1918 and 1919. This was largely, if not entirely, due to the more favorable weather conditions during the month of May.

In work done during 1916, Posey found blister rust infection upon wild *Ribes* bushes upon one of the Isles of Shoals off Portsmouth, N. H. In 1920, Snell found three bushes infected in early July upon two different islands, the infections being approximately 7 miles distant from the nearest land. It seemed practically certain that the spores had been carried from the mainland to the islands in some manner, probably by the wind.

Studies by York were made with each of the three spore forms, pycnia, aecia, and uredinia, on the fresh growth of the season of *Pinus strobus*, the inoculations being made in the axils of the leaves, the axils of the leaf fascicles, the terminal buds, and on the internodes both wounded and unwounded, the results in each case being negative. From experimentation indicated it appears that reeradication of *Ribes* may not be necessary very soon, as formerly believed, and in some cases may not be necessary for a long time.

Studies were carried on by Spaulding on *P. strobus*, *P. flexilis*, *P. cembra*, *P. mugho*, *P. sylvestris*, and *P. densiflora*. In the spring of 1920 every tree of *P. flexilis* was badly infected and 8 out of 10 bore fruiting bodies. A number of *P. strobus* trees have shown the disease, but this is true of no other species. Apparently *P. flexilis* is more susceptible than is *P. strobus*.

Two points brought out by this year's investigations are regarded as especially important. *Ribes* is often killed in intensive outbreak areas, so that some years later the absence of *Ribes* in such areas can not be taken as showing it has been absent previously. The numerous cases of breaking of the quarantine in the Mississippi Valley show very plainly that this quarantine must be rigidly enforced or the blister rust certainly will become established west of that line.

This season's work has confirmed previous conclusions that the aeciospores may be blown an indefinite number of miles and cause infection of *Ribes*.

The western yellow pine mistletoe: Effect on growth and suggestions for control, C. F. KORSTIAN and W. H. LONG (*U. S. Dept. Agr. Bul. 1112* (1922), pp. 36, pls. 5, figs. 4).—The western yellow pine (*Pinus ponderosa*) is said to be subject to severe injury by mistletoe (*Razoumofskyia cryptopoda*). This mistletoe causes a marked decrease in the rate of growth of the host, ultimately destroying the tree. The decrease in the rate of diameter and height growth of trees infected with mistletoe is accompanied by a reduction of leaf surface. Trees of all ages are said to be subject to mistletoe infection, provided the seeds of the parasite fall on parts of the tree which are not protected by the bark. The quantity and quality of the seed produced by infected trees are reported to be below that of normal, healthy trees. Heavily infected trees are practically worthless for seed production and should not be left as seed trees.

The most practical method of controlling mistletoe is said to be the removal of infected trees while cutting operations are in progress.

Notes on sap stain fungi, E. E. HUBERT (*Phytopathology*, 11 (1921), No. 5, pp. 214-224, pl. 1, figs. 4).—Information is presented regarding two stains found in the sapwood of commercial woods.

The stain produced by *Lasiosphaeria pezizula* is usually grayish olive in color and is found in both sapwood and heartwood. The stain produced by *Ceratostomella* spp. is grayish blue and is confined almost entirely to the sapwood.

The perithecia of *L. pezizula* are minute, spherical black bodies showing a craterlike collapse when old. These are gregarious upon a mat of olivaceous-black hyphae resting upon the surface of the wood. The blue-stain fungi produce minute flask-shaped perithecia with beaks of various lengths.

The hyphae of *L. pezizula* and *Ceratostomella* spp. penetrate the walls of the wood fibers and tracheids. It is apparent that these fungi affect the cell walls of their hosts to a certain extent.

The blue-stain hyphae, dormant in the wood for a considerable time, remain capable of reviving and sending forth new hyphae on the return of favorable growth conditions. The new hyphae usually originate from the old, anastomosed hyphae found in the medullary rays and are influenced in their development by the media and the contained air.

Tests of strength, so far as reliable, indicate a slight weakening effect due to the blue stain caused by *Ceratostomella* spp. The moisture content of the test pieces plays an important part in the testing of matched sticks.

The slight weakening due to blue stain, though in itself of little importance in larger material, serves to hide the effect produced by wood-destroying fungi which often accompany it. In this way it may affect wood of smaller dimensions to an appreciable extent. The failure of blued wood while undergoing steam bending suggests a new and practical field of investigation.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

A textbook of zoology, T. J. PARKER and W. A. HASWELL (*London: Macmillan & Co., Ltd., 1921, 3. ed., [ocr.], vols. 1, pp. XI+816, figs. 713; 2, pp. XX+714, figs. 540*).—A third edition of this standard work, of which the first edition was issued in 1898 and the second in 1910. The 11 lower phyla of the animal kingdom are dealt with in the first volume, and the phylum Chordata in volume 2. Volume 1 includes a discussion of the general structure and physiology of animals (pp. 10-44), while volume 2 includes discussions of distribution (pp. 599-622), the philosophy of zoology (pp. 623-646), and the history of zoology (pp. 647-669).

In this third edition the junior author has again carefully revised all parts of the work, and, in addition to introducing a number of minor alterations and some new illustrations, has rewritten certain portions, notably in the sections on the phyla Nemathelminthes, Mollusca, and Annelata.

The parasites of hematophagous invertebrates, G. LAVIER (*Les Parasites des Invertébrés Hématophages: Parasites qui leur Sont Propres Parasites qu'ils Transmettent aux Vertébrés. Paris: Vigot Bros., 1921, pp. 218, figs. 3*).—The several chapters of this work deal respectively with leeches, acarids, anoplurans, hemipterans, siphonapterans, dipterans, and insect flagellates. The work includes a bibliography of 34 pages (pp. 173-207) and an index to the hosts and to the parasites.

Feeding habits of moles, F. L. HISAW (*Jour. Mammalogy*, 4 (1923), No. 1, pp. 9-20).—This is a report of observations at the Kansas Experiment Station.

The author finds the mole to be predominantly carnivorous in its food habits, but that it will eat certain seeds and vegetables even when supplied abundantly

with insects and worms. "Corn is eaten very readily, while wheat and oats are eaten only occasionally. Peas, beans, and kafir are not eaten. Moles will eat ripe tomatoes, apples, and Irish potatoes. Sweet potatoes and carrots are very rarely eaten, while turnips and raisins are always refused. Moles are capable of living and maintaining their body weight on a ration of fresh beef, Irish potatoes, and apples, even though the beef is offered only every other day. Of the foods most commonly eaten, the following preferences are shown: Earthworms and white grubs, insect larvae other than white grubs, adult insects, corn, ripe tomatoes, and Irish potatoes and apples.

"The average daily food consumption is 32.08 per cent of the body weight of the animal. A mole is capable of eating 66.6 per cent of its body weight in 18 hours. The mole captures and kills active prey either by crushing it against the sides of the burrow with the front paws, or by piling loose earth on it and biting the victims held in this way. The mole, perhaps, does more good than harm in uncultivated areas by destroying quantities of injurious insects, but in cultivated fields it is decidedly harmful."

Insect conditions of the year 1921 in Massachusetts, H. T. FERNALD (*Massachusetts Sta. Rpt. 1921, pp. 50a-62a*).—In reporting upon the occurrence of insects in Massachusetts in 1921, attention is called to the fact that two unusual pests appeared and were injuriously abundant. The first of these, the seed-corn maggot (*Hylemyia ciliatula* Rond.), which had never before been reported as injuriously abundant in Massachusetts, attacked onion fields in and near Whately, Hatfield, and Sunderland and was a source of considerable loss. The second, the bollworm or corn earworm, became abundant in all parts of the State except Berkshire County and was a source of injury to sweet corn, particularly the yellow types, although field and pop corn were also attacked. In some cases losses of 95 to 100 per cent were reported. Flint corn was only slightly injured. The details of correspondence relating to insects during the year are reported in tabular form.

Entomology, L. HASEMAN ET AL. (*Missouri Sta. Bul. 197 (1922), pp. 61-66*).—Brief accounts are given of the work conducted during the year.

Spraying and dusting work with the bollworm on corn failed to yield satisfactory results. Life history studies and control work with the codling moth are briefly reported upon. It was demonstrated that while practically impossible to eradicate the San José scale from peach trees by means of a spray, a proper application of most of the materials tested, and here reported in tabular form, gave good control. Paradichlorobenzene used against the peach-tree borer gave 100 per cent control in nearly every case. The application of sprays and dusts for the control of melon beetles led the author to continue the general recommendation that arsenical dusts or sprays be applied, preferably by use of light hand equipment. Studies of the life history and control measures for the Hessian fly and chinch bug are briefly referred to.

Aroostook potato insects, E. M. PATCH (*Jour. Econ. Ent., 15 (1922), No. 5, pp. 372, 373*).—The author presents a list of the hemipterous insects that were found to frequent the potato plant in Aroostook County, Me., in 1921.

Observations on insects attacking sorghums, W. P. HAYES (*Jour. Econ. Ent., 15 (1922), No. 5, pp. 349-356*).—This is a report of observations made during the course of investigations at the Kansas Experiment Station during the past few years. Under the heading of insects attacking the head, the author considers the sorghum webworm (*Celama (Nola) sorghivella* Rll.), the corn leaf aphid (*Aphis maidis* Fitch), the bollworm (*Leptoglossus* spp.), and the Angoumois grain moth. Insects attacking the stalks and leaves include the chinch bug and the spring grain aphid (*Toxoptera graminum* Rond.). Pests which

attack the planted seed include the kafir ant *Solenopsis molesta* Say, the seed corn maggot (*Hyalemyia ciliatula* Rd.), and *Pheidole* sp.

The relation of hard and alkaline waters to the preparation and dilution of sprays and dips, E. R. DE ONG (*Jour. Econ. Ent.*, 15 (1922), No. 5, pp. 339-345).—This is a report of investigations conducted in the Santa Clara Valley, Calif., where there is a great range in the quality of the water supply. It is pointed out that hard and alkaline waters form dangerous combinations with many forms of insecticides, and that softening of hard water with chemicals is only partially successful. He finds that water softening plants with a capacity sufficient for supplying a spray outfit and for domestic purposes also may be installed at a cost of a few hundred dollars.

"The use of dusting materials where practical in place of liquid sprays is desirable, in that the user is independent of the type of water found locally. Insecticides compatible with the salts commonly found in waters are desirable, and in many instances will prove a satisfactory solution of the subject. Examples of such substitutions are basic arsenate of lead instead of the acid (standard) type, arsenical dips in lieu of cresol preparations, and the stable oil emulsions which are made for use in waters."

Utilization of systematic observations on beet leafhopper (*Eutettix tenella* Bak.) and curly leaf on sugar beets, E. A. SCHWING and W. J. HARTUNG (*Jour. Econ. Ent.*, 15 (1922), No. 5, pp. 365-368).—A discussion by the entomologists of the Spreckels Agricultural Experiment Station in California.

The attraction of *Chloridea obsoleta* Fab. to the corn plant, J. W. MCCOLLOCH (*Jour. Econ. Ent.*, 15 (1922), No. 5, pp. 333-339).—Further investigations (E. S. R., 43, p. 358) conducted by the author at the Kansas Experiment Station have indicated that odor may be an important factor in attracting bollworm moths to the corn plant, and that it is worthy of further investigation. Over 60 per cent of the eggs were deposited during the period that the plants were in silk, and 52 per cent of these eggs were placed on the silks. The author is aware, however, that other factors must be considered.

Control of the strawberry leaf roller in the Missouri Valley, F. M. WADLEY (*Jour. Econ. Ent.*, 15 (1922), No. 5, pp. 356-360).—This is a brief report of investigations conducted by an agent of the U. S. D. A. Bureau of Entomology in Kansas in 1917 and 1918 and in Iowa in 1919. The author finds that lead arsenate with a soap spreader is well adapted to control of this insect.

The grape berry moth in 1922, R. H. PETTIT (*Michigan Sta. Circ.* 52 (1922), pp. 4, figs. 4).—A brief summary of information on the grape berry moth, which was never so destructive in Michigan as during the summer of 1922, the loss being caused by late larvae.

Dusting v. spraying for the codling moth in walnuts, H. J. QUAYLE (*Jour. Econ. Ent.*, 15 (1922), No. 5, pp. 371, 372).—A comparison of spraying with dusting as a means of controlling the codling moth in walnuts, made by the author in four different orchards during three seasons, shows a great difference in favor of spraying.

Host plant selection by Hessian fly (*Phytophaga destructor* Say), W. B. CARTWRIGHT (*Jour. Econ. Ent.*, 15 (1922), No. 5, pp. 360-363).—This is a report of investigations conducted by an agent of the U. S. D. A. Bureau of Entomology at Centerville, Ill., in the fall of 1921. Observations made daily have shown that adjacent and similarly prepared plots of wheat, barley, rye, and oats are subject to fly attacks in varying degrees.

"The order of selection for oviposition runs in descending order wheat, rye, barley, and oats. From data in which daily egg counts were made from a

numbered series of plants, the total number of eggs being considered 100 per cent, wheat received 68 per cent, barley 8.8, rye 22.8, and oats 0.4 per cent. Likewise accumulated egg counts made from a constant number of plants show that wheat received 73.4 per cent, barley 11.8, rye 14.5, and oats 0.3 per cent. Resultant larval infestation from the fall oviposition of the Hessian fly on wheat, barley, rye, and oats was primarily manifest in wheat and barley. Rye, though second in selection for oviposition, was scantily infested and oats not at all. The percentages of plants infested from these two series of plats were for wheat 96 and 98, for barley 64 and 62, and for rye 6 and 8, respectively."

Injury to bell peppers by *Blapstinus coronadensis* Blaisd. and *B. dilatatus*, R. E. CAMPBELL. (*Jour. Econ. Ent.*, 15 (1922), No. 5, pp. 363-365).—This is a report of observations by an agent of the U. S. D. A. Bureau of Entomology near La Habra, Calif., in the fall of 1921. The feeding of these two tenebrionid beetles on the stems at the surface of the ground resulted in a destruction of at least 25 per cent in the more seriously infested part of the fields. Experiments conducted by the author demonstrated that wet sprays were valueless, but that dry dusty material such as hydrated lime had a decided deterrent effect. When the lime was so applied as to cover the ground completely around the stem the beetles ceased to feed.

Mississippi bark beetles, M. W. BLACKMAN (*Mississippi Sta. Tech. Bul.* 11 (1922), pp. 3-130, pls. 18, fig. 1).—This report of studies of the bark beetles occurring in Mississippi, issued as a contribution from the Mississippi State Plant Board, the station, and the New York State College of Forestry, deals with the subject under the headings of vegetation areas and distribution of bark beetles (pp. 4-17), the habits of bark beetles, including types of burrows and reproduction (pp. 17-27), economic importance of bark beetles, including injuries to forest reproduction, effect on the general health and growth of trees, killing of trees, injuries to timber during the process of lumbering, and injuries to utilized timber (pp. 27-30), factors influencing injury by bark beetles (pp. 30-33), prevention and control of bark beetle injuries (pp. 33-37), and classification and discussion of species (pp. 38-121). Three species and one variety are described by the author as new to science. The paper includes a bibliography of 76 titles and an index to the genera and species.

Paradichlorobenzene as a fumigant in the entomological museum, H. H. KNIGHT (*Ent. News*, 34 (1923), No. 2, p. 57).—The author has found that the adults of the confused flour beetle (*Tribolium confusum*) are killed by paradichlorobenzene in from one to six hours, depending upon the amount of crystals used in the boxes and drawers. A few crystals when placed in a tight drawer were found to kill dermestid larvae in from one to four hours. It is stated that while paradichlorobenzene evaporates somewhat more rapidly than naphthalene, yet 0.5 oz. placed in a tight case will last from five to eight weeks, and the gas may still be effective for three or four months in unopened cases.

Boll weevil control (*South Carolina Sta. Rpt.* 1922, pp. 39-44, 64, 65).—This is a discussion of the occurrence of the boll weevil in the State during the year, and of the control work conducted, including tabular data on dusting experiments with calcium arsenate applied in several localities and with different kinds of machines. The average gain in seed cotton in the two tests at Darlington was 579 lbs. per acre, with an estimated net gain in one of \$60 per acre. In work at the Pee Dee Substation an increase of 185 lbs. of cotton per acre over check plats was obtained where four applications of calcium arsenate were made.

Relation of moisture to ingestion of poison by the cotton boll weevil, D. C. WARREN (*Jour. Econ. Ent.*, 15 (1922), No. 5, pp. 345-349).—Investigations conducted by the author in Georgia have led to the conclusion that the cotton boll weevil is poisoned by ingestion of the arsenical with its food rather than by drinking the poisoned dew. It is pointed out that this conclusion has nothing to do with the time of day that the poison should be applied, since it is a well-established fact that better results can be obtained from applying poison while the plant is wet with dew.

The effect of activity on the length of life of honeybees, E. F. PHILLIPS (*Jour. Econ. Ent.*, 15 (1922), No. 5, pp. 368-371).—The author finds that the rapidity of death by starvation occurs in direct proportion to the work the bees are called upon to do, and that when death from starvation occurs rapidly there is still a food reserve which has not been depleted. "The relation between the work done and the death rate is quite in keeping with what has been so frequently observed for normal bees, namely, that the normal term of life, barring accidents, is determined by the amount of work which the individual is called upon to do."

Flight studies of the honeybee, W. PARK (*Amer. Bee Jour.*, 63 (1923), No. 2, p. 71).—This is a report of studies conducted by the author at the Iowa Experiment Station during the years 1920 and 1921 with a view to securing information on the speed of the bee and its reactions to the influence of the wind. The records have shown that there is considerably less variation in the time required for homeward bound bees than for outward bound bees.

"On the average, less time was consumed on the homeward trip than on the outward trip but, when flying directly against the wind, the empty bee flew slightly faster than did the loaded bee. The effort put forth by empty and by loaded bees was least when flying with the wind and greater when flying against it. A maximum speed of 25 miles per hour was found for both outgoing and incoming bees. Bees made but little progress against a wind having a velocity of 15 miles per hour. The average speed found for the flight of bees in a calm was a little less than 15 miles per hour."

Collected leaflets on beekeeping (London: Min. Agr. and Fisheries, 1922, pp. 46, pls. 5, figs. 9).—This pamphlet includes advice to beginners in beekeeping, methods of obtaining strong colonies of bees for wintering, and information on how to increase colonies, on beeswax, on the preparation and packing of honey for market, on foul brood, and on diseases of adult bees, namely, Nosema disease, acarine disease, and dysentery.

Ant control on shipboard, W. T. CLARKE (*Jour. Econ. Ent.*, 15 (1922), No. 5, pp. 329-333).—This is a report of an investigation made by the author of the infestation by ants of passenger ships running between the Pacific and Atlantic coasts of the United States by way of the Panama Canal.

The ants, which caused considerable pecuniary loss through the destruction of foodstuffs and also attacked passengers and the crew, their bite being very painful and causing a local swelling and inflammation and much itching, were identified by W. M. Wheeler as *Monomorium* (*Parholcomyrnex*) *destructor* Jord. Leaving San Francisco December 12 on an infested vessel, the author found the ants to increase in numbers as the warmer climate was reached, till on arrival at Manzanillo, Mex., on December 19, they had become exceedingly troublesome in the passengers' rooms and in the quarters of the steward's crew, pantries, galleys, and storerooms.

In control experiments a powder, devoid of disagreeable characteristics, consisting of sodium fluorid six parts, pyrethrum (buhach) powdered stems and flowers two parts, and cornstarch two parts (all by bulk) was found to be very efficient, and numerous observations showed that the death of the ants fol-

lowed in from 20 to 30 seconds after the material had touched them. With free use of this insecticide the ants were well under control by the time the ship arrived at San José de Guatemala on December 23. The author's investigations led to the recommendations that the infested ships be fumigated with sodium cyanid gas, and that sweetened arsenical baits be employed in addition to the above-mentioned powder. These recommendations were acted upon and the economic control of the pest on shipboard accomplished.

Some new injurious Phytophaga from Africa, G. E. BRYANT (*Bul. Ent. Research*, 12 (1922), No. 4, pp. 473-475, figs. 4).—Four pests are here considered, namely, *Crioceris viridissima* n. sp., which attacks asparagus in Kenya Colony; *Cercyonia citri* n. sp., a serious pest of young citrus trees and widely distributed in the Gold Coast; *Argopistes oleae* n. sp., which mines the leaves of olive trees in Cape Town; and *A. serrvittatus* n. sp., which is a leaf-miner on wild olive in Cape Province, Natal, and the Orange Free State.

Two injurious fruit mites in Pennsylvania, S. W. FROST (*Jour. Econ. Ent.*, 15 (1922), No. 5, p. 372, pl. 1).—Brief reference is made to the European plum mite (*Paratetranychus pilosus* C. & F.), which was a source of injury to apple and plum and to some extent to cherry and peach, and to *Phyllocoptes cornutus* Banks, which has recently been found very abundant in parts of the State on peach.

FOODS—HUMAN NUTRITION.

The comparative sweetness and preserving quality of cane and beet sugars, J. P. OGILVIE (*Jour. Soc. Chem. Indus.*, 41 (1922), No. 16, pp. 343R-345R).—In this general discussion of the subject it is pointed out that since refined beet and cane sugar both have a sucrose content of about 99.95 per cent there can be no detectable difference in the sweetness or in the preserving quality of the two sugars, but that in the direct-consumption or unrefined sugars impurities are present which affect the sweetness of the product. Direct-consumption cane sugars generally contain reducing sugars and may have a slight acid reaction, while corresponding beet sugars do not contain reducing sugars, and in the lower grades may be slightly alkaline. Evidence is cited that traces of acid enhance, and of alkali depress, the sweetening effect of a solution of sugar. A further difference in taste may be due to the presence of odoriferous substances or other impurities.

In regard to the preserving quality of cane and beet sugar, it is noted that in a low-grade beet sugar the presence of alkaline carbonates may lower the acidity of the fruit juice below the optimum for the setting of the pectin, but that this condition is not likely to be encountered at the present time.

The food value of Philippine bananas, W. SALVADOR (*Philippine Jour. Sci.*, 20 (1922), No. 3, pp. 363-366).—Tabulated data are given on the analysis of 12 varieties of Philippine bananas for water, ether extract, protein, sucrose, reducing sugars, crude fiber, ash, and total acidity calculated as sulphuric acid. Calculations of the calorific value per 100 gm. of food are also included.

Growth and nutrition, L. RANDOIN (*Bul. Soc. Sci. Hyg. Aliment.*, 10 (1922), No. 5, pp. 268-306, fig. 1).—This is a concise summary of the physiological needs of the growing child and the rôle played in growth by various food constituents, together with practical suggestions for the selection of food for babies and growing children.

The food requirements of children.—V, Percentage distribution of calories, L. E. HOLT and H. L. FALES (*Amer. Jour. Diseases Children*, 24 (1922), No. 4, pp. 311-319, figs. 5).—In this continuation of the series of studies previously noted (E. S. R., 47, p. 766), consideration is given to the relation

of the various food constituents to one another and of each to the diet as a whole. The percentage distribution in protein, fat, and carbohydrate of the calories in the diets of the 106 healthy children of the previous studies was found to be as follows:

The percentage of total calories taken as protein ranged from 11 to 23 per cent, with more than one-half the values between 14 and 16 per cent, and with the average value of all cases regardless of age 15 per cent. The fat varied from 21 to 51 per cent, with three-fourths of the values between 30 and 40 per cent and the general average 34. Carbohydrates ranged from 38 to 65 per cent, with three-fourths of the values between 44 and 55 per cent, and an average of 51. Using the average distribution of calories and the total caloric requirements as estimated in a previous study (E. S. R., 45, p. 162), the theoretical requirements of fat, carbohydrate, and protein have been calculated and compared with the estimated requirements given in the two previous papers. The corresponding values agree very closely. It is concluded that in round numbers "a diet in which the fat supplies 35 per cent of the total calories, the protein 15, and the carbohydrate 50 per cent, is one which meets the nutritive needs of the child after infancy, which is well borne by the digestive system, and [which] may be considered a well-balanced ration."

The relation between breast and artificial feeding and infant mortality. R. M. WOODBURY (*Amer. Jour. Hyg.*, 2 (1922), No. 6, pp. 668-687).—In the course of studies conducted by the Children's Bureau, U. S. Department of Labor, on infant mortality in eight American cities, data were obtained for 22,422 babies on the kind of feeding each month until one year of age or until death in the case of those who did not survive the first year. These data have been made the subject of a statistical study on the relation between breast and artificial feeding and infant mortality. The tabulated results of the different phases of this study are presented and discussed, with the conclusion that "artificial feeding, as actually practiced in typical city populations, is associated with a mortality between three and four times as high as the mortality among breast-fed infants. This excess mortality is not to be explained, either, by the slight overweighting of the group of artificially-fed with infants in certain groups characterized by high mortality rates, and it appears in all nationality and in all earnings groups, though with variations depending probably upon the particular conditions prevailing in the groups."

A clinical and chemical study of butter soup feeding in infants. A. BROWN, A. M. COURTNEY, and I. F. MACLACHLAN (*Amer. Jour. Diseases Children*, 24 (1922), No. 5, pp. 368-381).—A modification of the butter-flour mixture of Czerny and Kleinschmidt has been used by the authors in the feeding of a large number of babies both in hospital and private practice. Clinical observations are reported on 104 such cases, and chemical studies of the intake, output in urine and feces, and retention of fat, nitrogen, and total salts in four infants on this diet.

The butter soup used in all these studies contained butter 7.25, granulated sugar 5.25, and flour 14.75 level teaspoons, with water 17.5 oz. In preparing the food, the butter is melted over a low flame and heated until it stops foaming and becomes a dark color, this requiring about 7 minutes. The flour and sugar are then blended with the butter and the cold water added with constant stirring for about 5 minutes or until the mixture thickens, after which it is heated in a double boiler for 30 minutes and then made up to 20 oz. with boiled water. This mixture without milk furnishes about 28 calories per ounce. For an infant weighing 7 lbs., 14 oz. of butter soup and 7 oz. of whole milk are given in seven feedings.

Of the entire number of cases reported only five lost weight and did not do well on this food. Premature and young babies made the most substantial gains and showed improvement in vigor, in tissue turgor, in disposition, and in resistance to infection. In a few cases signs of mild rickets or a condition simulating mild rickets were seen after the continued use of the butter soup. The stools with this food were acid, resembling those with breast-milk feeding, but much larger.

The percentage retention of fat, nitrogen, and total salts for 3 of the children was as follows: Fat 81.6, 72.1, and 81.4 per cent; total nitrogen 7.9, 7.5, and 38.5; and total salts 34.6, 13.5, and 12.5 per cent. The fourth child gave a percentage retention of fat of 73.4, and a negative nitrogen and salt balance. The retention of calcium and magnesium was excellent in the other 3 children. The feces contained an excess of inorganic bases over inorganic acids and the urine the reverse condition. These findings are discussed at length, although no satisfactory explanation is given of the apparent inconsistency of some of the low retention values with the excellent clinical results obtained with this food. It is concluded that butter-flour mixture is valuable in the feeding of premature, small, and undernourished children who are not suffering from any acute digestive disturbance.

The failure of yeast therapy in the feeding of infants, W. C. DAVISON (*Amer. Jour. Diseases Children*, 24 (1922), No. 4, pp. 339-345, figs. 3).—In a limited number of cases of patients convalescent from acute intestinal indigestion and infants suffering from chronic intestinal indigestion, the administration of yeast was found to be without benefit and in some cases possibly to be harmful.

Experiments with vitamin A in carrots, H. VON EULER (*Arkiv Kemi, Min. och Geol.*, 8 (1921), No. 3-4, Art. 18, pp. 7, figs. 2).—This is the first of a series of studies on vitamin A, white mice being used as the experimental animals. The young were kept for 18 days with the mothers, whose food for the first 12 days consisted of meat, dry bread, milk, and cream. From the twelfth day on the food was changed to the basal vitamin A-free ration described by Drummond and Coward (*E. S. R.*, 44, p. 764), supplemented by the addition of milk and cream. On the eighteenth day the young were removed from the mothers and placed in two groups, one of which received the basal ration alone and the other the basal ration supplemented with the food to be tested for vitamin A.

In the experiments reported in this paper various preparations of carrots were used. The finely divided carrots were extracted with five times their volume of benzene for 8 hours, the benzene distilled off from the extract, and the extract taken up in ether and evaporated in vacuo. Preparations by methods previously described (*E. S. R.*, 20, p. 708) were also made of phytosterol and daucosterol, phosphatids, and zymophosphate from carrots. All of these were tested for their content of vitamin A by adding them to the food mixture in the proportion of 5 parts to 100. Good growth was obtained with the benzene extracts and very slight growth with a combination of the phytosterol and daucosterol, but not with the phytosterol or with a phosphatid mixture and the zymophosphate as sources of vitamin A.

Working conditions for vitamin A, H. VON EULER (*Arkiv Kemi, Min. och Geol.*, 8 (1922), No. 3-4, Art. 19, pp. 10, figs. 3).—In this paper the author outlines the method he has adopted for the quantitative study of vitamin A. In addition to the technique described in the above paper several features considered important are discussed. One of these is the selection of animals for the test. From the second day after birth the mice are weighed separately in a tared beaker, and from a study of the growth curves only those which are growing in a normal manner are used for further tests.

In the experimental work reported the growth curves are shown of mice on the vitamin-free basal ration supplemented by 0.1 and 0.2 gm., respectively, of the dried residue of the benzene extract of carrots per 10 gm. of the basal diet. The first gave an approximately maintenance curve and the second slight growth, which was somewhat less than similar curves obtained with 0.1 and 0.4 gm. of fresh butter, respectively. A curve approaching normal was obtained with 0.1 gm. of carrot residue and 0.1 gm. of butter fat.

In a further series of experiments the effect was noted of varying the feeding of the constituents of the basal ration. When all of the constituents were fed daily, a regular growth curve was obtained. When everything with the exception of the extracts furnishing vitamins was fed daily and yeast extract and orange juice were given on alternate days, the curve was very irregular. A similar irregularity was noted when yeast extract was given on one day, orange juice on the second, and salt mixture on the third. It is concluded that through the intermittent addition of B vitamin the action of the A vitamin can be significantly increased.

Physiological investigations on vitamin B and water-soluble biocatalyzers, G. J. BLOHM, C. G. SANTESSON, and H. VON EULER (*Arkiv Kemi, Min. och Geol.*, 8 (1921), No. 3-4, Art. 13, pp. 27, figs. 6).—Various extracts of yeast, including the biocatalyzers classified as previously noted (E. S. R., 46, p. 866) and also extracts of wheat germ, were injected intravenously into rabbits, and observations were made of the effect upon blood pressure and pulse rate.

The general effect of these preparations, whether active or inactivated by heat, was to produce a temporary lowering of the blood pressure and pulse rate. In one case only was there a marked difference between the active and inactive preparation. In this the active preparation, after a short period of lowering the blood pressure, increased it, while the inactive preparation caused a lowering only.

The relation of vitamins to the growth of a streptococcus, S. H. AYERS and C. S. MUDGE (*Jour. Bact.*, 7 (1922), No. 5, pp. 449-464).—An extensive study is reported from the Dairy Division, U. S. D. A., of the effect of certain materials on the growth of a pathogenic streptococcus which was known to grow slowly in a peptone yeast medium.

Several experiments were first conducted to determine whether vitamin B stimulates the growth of this organism. To three tubes of regular Difco peptone medium were added a 95 per cent alcoholic extract of yeast, a water extract of the yeast residue from the alcoholic extraction, and autolyzed yeast, respectively. The tubes were then inoculated with a 24-hour culture of the streptococcus, incubated at 37° C., and examined after 17, 24, and 48 hours. Only slight growth was obtained in the medium containing the alcoholic extract of the yeast and considerably better growth in the other two media.

Similar tests were made with fractions obtained from autolyzed yeast by the method of Osborne and Wakeman (E. S. R., 42, p. 314). The fractions which should contain vitamin B did not stimulate growth, but the one which should contain little, if any, vitamin B gave considerable growth. The extract obtained after shaking yeast with fuller's earth also stimulated growth. The results of these tests, which are in harmony with those of Freedman and Funk, previously noted (E. S. R., 48, p. 559), indicate that the growth-promoting substance for streptococci present in yeast is not identical with vitamin B.

Water extracts of cabbage were found to promote growth of streptococci in peptone media to a degree roughly proportional to the amount of extract.

The addition of glucose to the peptone in concentrations equivalent to the calculated reducing sugar of the various cabbage extracts also resulted in an increase of growth. In this connection the authors emphasize "that when extracts of plant tissues are used as a source of growth-promoting substances, the possible effect of sugar and other reducing substances present must be given considerable thought before the growth promotion can be attributed to vitamins. This is not only true when plant tissues are used, but holds equally well for any extracts which may contain sugars."

Studies were also made of the effect of various fats and oils on the growth of the same streptococcus in a medium consisting of 10 gm. of Difco peptone, 10 of autolyzed yeast, and 1,000 cc. of distilled water. To 50 cc. of this medium 0.5 cc. of the fat or oil was added before sterilization at 15 lbs. pressure for 30 minutes. Butter fat, cod liver oil, olive oil, and white mineral oil were found to stimulate growth of the streptococci to a considerable extent. This was confirmed by a more quantitative study involving final plating on infusion agar. A large number of animal and vegetable oils, mineral oil, vaseline, and paraffin appeared to stimulate growth.

The test was repeated with diminishing amounts of butter fat, rape oil, and mineral oil. Even with the smallest amount used, 0.002 per cent of the oil, there was marked stimulation of growth. The stimulating effect of the fats and oils was not manifest to any degree, however, in plain peptone without yeast.

The authors suggest in conclusion that "either the growth-promoting property of fats and oils is not due to fat-soluble A, or this vitamin is present in mineral oils, or the stimulation is due to different causes in the case of the vitamin-containing fats and oils and the mineral oils."

Infantile rickets: The significance of clinical, radiographic, and chemical examinations in its diagnosis and incidence, A. F. HESS and L. J. UNGER (*Amer. Jour. Diseases Children*, 24 (1922), No. 4, pp. 327-338).—This discussion of the diagnosis and incidence of rickets is based chiefly upon the authors' experience in the examination of over 250 babies less than 18 months of age who have been cared for under similar hygienic and well-controlled dietary conditions.

It is concluded as a result of these observations that of the important clinical signs the most reliable is beading of the ribs. Roentgen ray examinations are considered of greater value in judging the beginning of healing of rickets than in detecting its presence in early stages. While a lowering of the inorganic phosphate of the blood generally results in the early stages of the disease, this change is not specific for rickets.

A study at the end of March of the incidence of rickets among 25 breast-fed babies from 4 to 10 months old showed rickets in more than 50 per cent of the cases. With regard to bottle-fed babies it has been the authors' experience that if the incidence is studied when the disease is at its flood, i. e., from March to April, and if special means such as direct exposure to sunlight is not taken to prevent the disease, nearly all give some indication of rickets.

Experimental polished rice diseases in humans, K. TAGUCHI, S. HIRAIISHI, and F. KWA (*Japan Med. World*, 2 (1922), No. 5, pp. 133-135).—A brief report is given of the symptoms induced in healthy human subjects, three men and two women, by a diet of polished rice and water with or without salt. In all five cases symptoms of so-called polished rice disease appeared in a short time. All suffered from loss of appetite; digestive disturbances, particularly constipation; sensory disturbances; motor paralysis; and decreased blood pressure. Treatment with rice bran extract resulted in a rapid recovery.

Food poisoning and its prevention, C. THOM (*Amer. Food Jour.*, 17 (1922), No. 11, pp. 15, 16, 33-36).—This paper, presented at the convention of the Association of American Dairy, Food, and Drug Officials at Kansas City, Mo., in October, 1922, consists of a concise summary of the present status of information on food poisoning and of the gastro-intestinal type commonly misnamed ptomaine poisoning both of the type affecting the central nervous system, botulism. Specific suggestions are included for the consumer on the inspection of cans of food and on the treatment of doubtful cans, for the dealer in handling canned food, and for the home canner in the preparation of the materials for canning and in the inspection of the cans on opening.

Presumptive test for the etiologic factor in bacterial food poisoning, V. BURKE and C. W. MAY (*Jour. Amer. Med. Assoc.*, 79 (1922), No. 20, pp. 1669-1674).—The authors classify the causes of food poisoning in four groups as regards diagnosis: (1) Bacterial toxins, (2) organisms of the paratyphoid-enteritidis group, (3) ptomaines and naturally poisonous foods such as toad-stools, and (4) chemical poisons consisting chiefly of the poisonous metals. The chief differential characteristics of these groups are enumerated, and methods are described for a rapid confirmed test for the toxin of *Clostridium botulinum* (*Bacillus botulinus*) combined with a slow presumptive test for the organisms of the paratyphoid-enteritis group and a rapid presumptive test for the presence of botulinus toxin which may be used when antitoxin is not available.

For the first test 2 cc. of the unfiltered liquor to be examined is placed in each of five serum tubes. To the first nothing is added; to the second and third 1 cc. of botulinus antitoxin, Type A and Type B, respectively. The fourth tube is placed in boiling water for 10 minutes, and to the fifth tube is added 0.5 cc. of 10 per cent hydrochloric acid and the tube allowed to stand for 10 minutes. The contents of each tube are neutralized to litmus with a saturated solution of sodium bicarbonate, and then injected into the marginal ear vein of a medium-sized rabbit. The animals injected with the contents of the first three tubes serve as a confirmed test for botulinus toxin. If the fourth rabbit shows symptoms, botulinus toxin is eliminated from consideration, and it may be assumed but not proved that organisms of the paratyphoid group are present. The results obtained with rabbit five are of value as a check on the results obtained with the other rabbits, particularly on the possible presence of both types of botulinus toxin.

The presumptive test for the presence of botulinus toxin in the absence of antitoxin can be made from the first, fourth, and fifth tests outlined above. If botulinus toxin is present, rabbits one and five will die and rabbit four will show no symptoms.

A brief report is given of an outbreak of botulism at Walla Walla, Wash., in which home-canned asparagus was involved. This was heated for a few minutes before the peculiar odor of botulinus toxin was noted. One person ate part of a stalk and another a whole stalk. The first died of botulism eight days later, while the second escaped illness, probably due to the fact that the particular piece of asparagus eaten had been sufficiently heated to destroy the toxin. Twenty-three chickens out of a flock of 35 which had been given the spoiled asparagus died, 6 on the first day.

Table utensils as sources of tuberculous infection, C. FLOYD and L. FROTHINGHAM (*Amer. Rev. Tuberculosis*, 6 (1922), No. 1, pp. 51-62).—The possibility of the transmission of tuberculous infection from table utensils by open consumptives was studied by the examination of the thoroughly washed table utensils used by consumptives in 25 private homes and of the water employed to wash this tableware. The utensils were carefully swabbed with

sterile cotton moistened with salt solution and the suspension cultured and injected into guinea pigs. The wash water was allowed to settle, the top liquid decanted off, and the remainder, including the sediment, strained through cheesecloth and centrifuged. The final sediment was taken up in salt solution and injected into guinea pigs. One positive result was obtained from the utensils and four from the wash water, or 2 and 21 per cent, respectively.

"From these experiments it seems evident that the table utensils used by an open consumptive may be not only a menace to the patient himself and to others in his family, but also a general menace when the patient eats in public places. The inference also seems warranted that the dish towel used to wipe these utensils must become contaminated with virulent tubercle bacilli, and the more frequently it is used the more bacilli accumulate, so that if employed for several days without thorough washing, a common practice in many homes, it becomes more and more a depository of tubercle bacilli on the just washed utensils. It would seem, therefore, that the only way to control the danger of spreading tuberculosis by such utensils is to thoroughly sterilize the patients' tableware and the dish towel employed to wipe it, after each meal, and the simplest method to accomplish this is to boil them for several minutes."

ANIMAL PRODUCTION.

Feeds and feeding. W. A. HENRY and F. B. MORRISON (*Madison, Wis.: Henry-Morrison Co., 1922, 18. ed., rev., pp. V+770, figs. 7.*)—This is the eighteenth edition of the book previously noted (*E. S. R., 34, p. 261*), which has been revised and enlarged by the junior author to include the results of the more recent investigations in animal feeding. New standards called the Morrison feeding standards and net energy values of feeding stuffs for ruminants have been added, as well as a table in which the relative vitamin content of the different stock feeds is designated.

Feeds and feeding. W. A. HENRY and F. B. MORRISON (*Madison, Wis.: Henry-Morrison Co., 1923, 18. ed., rev., pp. X+770, pls. 95, figs. 7.*)—This is an illustrated edition of the book noted above.

A possible cattle food. E. P. PHILLIPS (*Union So. Africa Dept. Agr. Jour., 4 (1922), No. 4, pp. 361-365, fig. 1.*)—Attention is called to the possible feeding value of the seeds of *Scsbania mossambicensis* and *S. cinerascens*. Chemical analyses show that these seeds contain, respectively, 9.6 and 11.4 per cent of water, 32.9 and 21.7 per cent of crude protein, 6.2 and 4.8 per cent of fat, 39 and 47 per cent of nitrogen-free extract, 10.9 and 12.2 per cent of fiber, and 1.4 and 2.9 per cent of ash.

A substance giving a reaction similar to an alkaloid was found to be present in both kinds of seed, but the fact that the *mossambicensis* seeds have been used in South Africa as a poultry feed would indicate that no injurious substances are present.

Feeding stuffs inspection. J. L. HILLS, C. H. JONES, G. F. ANDERSON, and A. S. LUTMAN (*Vermont Sta. Bul. 228 (1922), pp. 15-22.*)—This is the usual report of the inspection of feeding stuffs for the year. Analyses were determined on the 762 samples for protein only as in the previous report (*E. S. R., 46, p. 572*).

The equivalence of age in animals. S. BRODY and A. C. RAGSDALE (*Jour. Gen. Physiol., 5 (1922), No. 2, pp. 205-214, pls. 2, figs. 4.*)—Treating data from various sources dealing with the growth rate of the rat, mouse, guinea pig, fowl, Holstein cattle, rabbit, sheep, and man, it was found that 13 times the conceptional age of the maximum of the third or adolescent cycle of growth gave a value which closely approximated the normal duration of life of each animal under favorable conditions, with the exception of man.

It is suggested that the age of the occurrence of the maximum of the third cycle of growth be used for estimating the equivalent physiological ages in different animals. Further observations deal with the conception ages at which the different growth cycles begin and reach their maximum, comparisons of the duration of the three cycles of growth, and their relationship to sex. In man the maximum of the third cycle is apparently closely associated with sexual maturity. The ox, sheep, pig, and guinea pig spend their first growth cycle in utero, whereas man, mouse, rat, and rabbit are born before the completion of the first or infantile cycle.

The physiology of reproduction, F. H. A. MARSHALL (*London and New York: Longmans, Green & Co., 1922, 2. ed., rev., pp. XVI+770, figs. 189*).—This book covers the physiology of reproduction in Mammalia, with some references to the associated reproductive processes in the lower forms. The following chapters are included in the book: The breeding season; the estrous cycle in the Mammalia; the changes that occur in the nonpregnant uterus during the estrous cycle; changes in the ovary, oogenesis, growth of follicles, ovulation, formation of corpora lutea and atretic follicles, the significance of the proestrous changes in the uterus; spermatogenesis, insemination; fertilization; the accessory reproductive organs of the male and the mechanism concerned in insemination; the testicle and the ovary as organs of internal secretion; the innervation of the female generative organs, uterine contraction, parturition, the puerperal state; lactation; fertility; the factors which determine sex; and phases in the life of the individual, the duration of life, and the cause of death. In addition there are contributions on *The Biochemistry of the Sexual Organs*, by W. Cramer; *Fetal Nutrition, the Placenta*, by J. Lochhead; and *The Changes in the Maternal Organism during Pregnancy*, by J. Lochhead and W. Cramer.

As genetics comes of age, E. M. EAST (*Jour. Heredity, 13 (1922), No. 5, pp. 207-214*).—A review of the development of genetics and a summary of the general laws of heredity are given.

Correlation, causation, and Wright's theory of "path coefficients," H. E. NILES (*Genetics, 7 (1922), No. 3, pp. 258-273, figs. 9*).—This is a criticism of Wright's theory of "path coefficients" (*E. S. R., 44, p. 766*). The author finds that the basis of the method is faulty and obtains inaccurate results by applying it to two selected problems. He also states that "in the hands of a man well acquainted with the realities in the field he is investigating this method would be likely to lead to results not far from the truth, because, if any values appear to be inconsistent, a new set-up of causes and effects will be made. Guesses by a trained man would be on the whole quite as good and much less work, whereas an untrained man can not be sure of the validity of his results at all because he is not familiar with the realities in the field of study."

Cattle feeding investigations, I, II, W. H. PETERS and N. K. CARNES (*Minnesota Sta. Bul. 200 (1922), pp. 5-33, figs. 12*).—Two experiments in feeding beef cattle are reported.

I. Fattening two-year-old steers for market (pp. 6-17).—For this test, which lasted 112 days, 48 two-year-old feeder steers were divided into 6 lots, all of which received rations containing clover hay, with the addition of the following feeds: In lot 1, shelled corn, linseed meal, and corn silage; lot 2, ground barley, linseed meal, and corn silage; lot 3, linseed meal and corn silage; lot 4, shelled corn; lot 5, ground barley; and lot 6, shelled corn and linseed meal. Six hogs, averaging about 115 lbs. at the start of the test, followed the steers in the lots in which shelled corn was fed, whereas 4 hogs were placed in lots 2 and 5, and 2 hogs in lot 3. Weights of the steers were taken every 28 days and the

results are reported in 28-day periods, as well as for the entire 112 days. The following table gives a summary of the entire test:

Summary of 112-day feeding test with two-year-old steers.

Lot.	Average initial weight.	Average daily gain.	Feed consumed per 100 pounds gain.					Feed cost per 100 pounds gain.	Per steer value of feed saved by hogs.	Estimated selling price per 100 pounds
			Shelled corn.	Ground barley.	Linseed meal.	Corn silage.	Clover hay.			
	Pounds	Pounds	Pounds	Pounds.	Pounds.	Pounds.	Pounds.			
1.....	1,011	2.33	623		110	1,163	282	\$13.07	\$2.49	\$7.70
2.....	1,014	2.56		581	100	1,078	278	13.31	.23	7.50
3.....	1,011	1.69			167	2,632	611	15.45	.19	6.75
4.....	1,014	2.08	872				592	11.26	2.39	7.40
5.....	1,008	2.09		930			575	13.50		7.40
6.....	1,007	2.25	745		125		568	13.48	2.84	7.25

The authors conclude that ground barley was fully equal to shelled corn for producing gains, but the pigs in lots receiving shelled corn saved \$2.57 worth of feed per steer, whereas in the ground-barley lots practically no feed was saved by the pigs. Where silage or silage and linseed meal were omitted from the ration the finish of the steers was not as good, and in the latter case the gains were reduced. The amount of grain required for fattening was increased in both cases, which also increased the feed cost. Where both corn and barley were absent from the ration, the feed cost was markedly increased and the finish was much reduced.

II. *Fattening calves for baby beef* (pp. 18-33).—This test was carried on to compare purebred, grade, and common beef calves for baby beef production and to study the efficiency of certain changes in a standard ration consisting of 60 per cent shelled corn, 30 per cent whole oats, and 10 per cent linseed meal fed with alfalfa hay to baby beefs.

Six lots of 10 calves each were selected for the test. Lots 1 to 4 were made up of purebred Herefords, lot 5 of high-grade Herefords, and lot 6 of common beef calves. The standard ration was fed to lots 4, 5, and 6, and was modified as follows for the other lots by the addition in lot 1 of two full feeds of corn silage per day, in lot 2 by the addition of one-half the amount of corn silage fed to lot 1, and in lot 3 ground barley replaced the shelled corn in the standard ration. Some delay occurred in starting the trial, which was officially begun on December 15, and on February 20 3 pigs were placed with each lot of calves. The pigs received additional corn and tankage to keep them gaining. The following table gives a summary of the test:

Summary of 196-day feeding test with baby beefs.

Lot.	Average initial weight.	Average daily gain.	Feed consumed per 100 pounds gain.						Feed cost per 100 pounds gain.	Per steer, value of feed saved by hogs.	Estimated selling price per 100 pounds.
			Shelled corn.	Ground barley.	Linseed meal.	Ground oats.	Corn silage.	Alfalfa hay.			
	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.			
1.....	493	2.36	330		51	131	508	181	\$6.72	\$1.60	\$9.30
2.....	482	2.33	358		54	138	258	208	6.85	1.48	9.30
3.....	494	2.11		398	62	156		276	8.13	.63	9.10
4.....	488	2.22	381		59	150		240	7.06	1.37	9.40
5.....	480	2.23	381		59	150		245	7.09	1.12	9.10
6.....	334	2.36	328		51	128		220	6.14	1.21	7.05

Satisfactory gains were obtained with the standard ration, but the addition of corn silage reduced the grain required and kept the calves on feed more regularly and produced somewhat better gains. When ground barley was substituted for shelled corn the calves gained more rapidly at first, but the rate of gain was decreased later in the test and the calves were harder to keep on feed. The importance of breeding in baby heeves is demonstrated by comparing the results of lots 4, 5, and 6.

[**Experiments with beef cattle at the Missouri Station**] (*Missouri Sta. Bul.* 197 (1922), pp. 41, 44, 45, 46, 47, fig. 1).—The results of the following experiments with beef animals are briefly reported:

Limited grain rations for fattening cattle of different ages, E. A. Trowbridge and H. D. Fox (p. 41).—One lot each of calves, yearlings, and 2-year-olds were fed on the ration used in the experiments in fattening steers previously noted (*E. S. R.*, 46, p. 364), and comparative lots were fed on the same ration without shelled corn. The lots in which shelled corn was fed were apparently better finished at the end of a 120-day feeding period.

Physical composition of beef, A. T. Edinger (pp. 44, 45).—Three beef steers, weighing approximately 1,000 lbs each, but of varying degrees of fatness, were selected for slaughter to study the variation in physical and chemical composition; relative amount of lean, fat, and bone; and nutritive value of the retail and wholesale cuts. Reference is also made to the most economical cuts to buy from a nutritional standpoint.

The dressing percentages of the thin, medium, and fat steers were, respectively, 52, 58, and 62 per cent. The loin and the plate made up a greater proportion of the fat carcass than of the lean carcass, but the reverse relationship existed with the chuck. The thin steer was found to contain 24 per cent more lean, 20 per cent less fat, and 5 per cent more bone than the fat steer. The plates, flanks, ribs, loins, round, and chuck ranked in the order given as to the amount of fat which they contained in all animals. The chuck from the fat steer contained 57 per cent lean, 18 per cent bone, and 24 per cent fat, while the chuck of the thin steer contained 66 per cent lean, 24 per cent bone, and 9 per cent fat. The cost of the protein in any of the cuts from the thin steer was cheaper, but the cost of 1,000 calories was less in the case of the fat steer.

Factors influencing the normal rate of growth in domestic animals and the permanency of the effects of arrested development, A. G. Hogan (pp. 46, 47).—The preliminary results of this experiment indicate that "if steers have been severely stunted as long as 3½ years, they will grow and fatten rapidly when placed on generous rations, but if stunted much longer than 2 years they do not attain the size normally expected."

Self-feeding calves, yearlings, and two-year-olds, G. BOHSTEDT (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 11-12, pp. 191-193).—A test is described in which 2 Angus calves, 2 Angus yearlings, and 2 Shorthorn two-year-olds received shelled corn, linseed meal, hay, and salt in separate self-feeders to determine the practicability of self-feeding fattening beef animals. Corn silage was supplied twice daily to the limit of their capacity. The test lasted 126 days for the two-year-olds and 182 days for the calves and yearlings. Average daily gains of 1.77 and 1.79 lbs. were made by the calves, 1.67 and 1.82 by the yearlings, and 1.48 and 2.56 lbs. were made by the two-year-olds.

"The indications are that self-feeding of this nature is not the most desirable method of fitting steers for the market, particularly in the case of the big steers." Feeding ear corn, with hogs following the steers, might have materially changed the results.

Silage and limited corn allowance for yearling and two-year-old steers, G. BOHSTEDT (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 11-12, pp. 179-185, figs. 4).—

In steer-feeding experiments three lots of 10 yearlings and three lots of 5 two-year-olds each were fed on modifications of a ration consisting of corn full fed, oil meal 2.5 lbs. per day, mixed hay, and corn silage. In lot 1 corn stover was fed in place of the silage and in lots 3 and 5 only one-half the amount of corn consumed by lots 2 and 4, respectively, were allowed, and in lot 6 no corn was fed. The average daily gains and calculated feed costs were, respectively, as follows: Lot 1, 2.28 lbs. and \$11.09; lot 2, 2.45 lbs. and \$9.28; lot 3, 2.15 lbs. and \$8.89; lot 4, 2.94 lbs. and \$8.63; lot 5, 2.86 lbs. and \$7.65; and lot 6, 2.4 lbs. and \$6.95. The respective selling prices per 100 lbs. were \$9.60, \$10, \$9.50, \$9, \$8.75, and \$8.50.

The results demonstrated the value of silage and corn in the ration of yearlings, whereas the two-year-olds were able to make better comparative gains than the yearlings on rations in which no corn or only limited amounts of corn were fed, due to their better utilization of roughage. Greater profits were calculated for the yearlings in lots 2 and 3 than for the two-year-olds.

Wintering beef cows, G. BOHSTEDT (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 11-12, pp. 186-191, figs. 5).—Twenty-eight Angus beef cows were divided into four lots and wintered on comparative rations. All cows received daily per head 1 lb. of cottonseed meal and all the oat straw they would eat, with the addition in lot 1 of 30 lbs. of corn silage, lot 2 full allowance of corn silage (average 47 lbs. per day), lot 3 full allowance of stover silage (average 25.5 lbs.) and 3.6 lbs. of corn, and lot 4 full allowance of dry stover (average 10.9 lbs.) and 3.6 lbs. of corn per day.

The feed costs of wintering the cows were calculated, respectively, in the different lots as \$17.78, \$21.59, \$18.78, and 19.72, and the respective gains made per cow and calf dropped were 93, 200, —11, and 41 lbs. It was concluded that the ration of 30 lbs. corn silage, full feed of oat straw (about 5 lbs.), and 1 lb. of cottonseed meal per day was a fairly cheap and satisfactory ration for wintering beef cattle. After the cows had been on pasture all summer the weights of all the animals from the different lots were found to be nearly equalized.

Practical tests in Karakul sheep breeding, C. C. YOUNG (*Jour. Heredity*, 13 (1922), No. 5, pp. 229-236, figs. 3).—Since Karakul sheep have been frequently crossed with other breeds in their native country and the stock has deteriorated by the slaughtering of the lambs with the best skins, the necessity for testing the breeding qualities of each ram to be used in producing Karakul wool is emphasized. All rams to be used in a flock should have demonstrated their ability to sire lambs having tight curled fleeces when crossed with domestic coarse-wooled ewes. The future of Karakul sheep breeding in this country is pictured as being very bright, since Karakul sheep have been found to be very hardy, especially in dry sections, and have produced good mutton and desirable wool where other sheep would starve.

[**Experiments with swine at the Missouri Station**] (*Missouri Sta. Bul.* 197 (1922), pp. 37-41, 41, 42, 45, 46) --The results of the experiments dealing with swine, carried on at the station, are briefly reported.

Relation of feed consumed to protein and energy retained in the carcass, E. A. Trowbridge, L. A. Weaver, A. G. Hogan, and A. T. Edinger (pp. 37-41).—For this test 8 bacon- and 8 lard-type hogs, averaging 93.9 and 93.1 lbs., respectively, were selected. One hog of each type was killed at the start of the test and when approximate weights of 150, 200, 250, and 300 lbs. had been attained others were killed. Chemical analyses of the entire slaughtered animals and physical examinations of the carcasses were made, as well as calculations of the energy retained and the surface area and daily maintenance requirements

of the slaughtered animals. The grain consumed per pound of gain was slightly less in the case of the smaller bacon hogs, but with the larger animals the lard hogs seemed to be the more economical users of food.

There was a difference of about 12 per cent in the dressing percentage of 100- and 300-lb. hogs, but type seemed to have no effect on dressing percentage. The hams and shoulders were found to consist of about 75 per cent lean in the 100-lb. hogs, with a reduction to about 60 per cent in the 300-lb. hogs, due largely to an increase in the fat content. The percentage of bone usually decreased with age. In the older animals the ratio of shoulder or ham to whole carcass was less than in the younger animals, while the reverse condition occurred in the case of the loin, bacon, and leaf fat. The shrinkage in the cooler and after curing was much less for the older animals. The fat from the 100-lb pigs produced only 38 per cent of rendered lard as compared with 83 per cent of rendered lard recovered from the fat of the 300-lb. pigs.

The chemical composition of both lard and bacon hogs of the same ages was very uniform, but age had a marked effect on the body composition. The percentage composition varied rather uniformly for 100 to 300-lb. pigs as follows for the lard-type animals: Moisture 61.33 to 42.29 per cent, protein 14 to 11.21 per cent, fat 15.11 to 41.11 per cent, and ash 2.88 to 2 per cent. Similar variations occurred in the bacon hogs. The energy retained, when expressed as percentage of energy consumed, varied only from 37.59 to 48.41 per cent, showing practically no relationship to age or type. The calculated energy required for maintenance per square meter of surface decreased with age from 3.028 therms at 125 lbs. weight to 2.498 therms at a weight of 275 lbs.

Rations for pigs at weaning time, L. A. Weaver (pp. 41, 42).—Eight lots of 10 pigs each were pastured on Dwarf Essex rape for 112 days and a ninth lot was pastured on blue grass. In addition, grain rations consisting of various combinations of corn, shorts, bran, tankage, ground (hulled) oats, and semi-solid buttermilk were fed to the different lots. Rations containing semisolid buttermilk or ground oats produced the best gains. Blue grass pasture seemed to be slightly superior to rape in this test. Corn alone with rape pasture produced the poorest gains. The addition of shorts and bran to a corn and tankage ration apparently did not improve it.

Hogging down corn and soy beans, L. A. Weaver (pp. 45, 46).—Another year's results of this experiment have differed little from the average of similar tests previously noted (E. S. R., 46, p. 364).

[*Experiments with swine at the South Carolina Station*] (*South Carolina Sta. Rpt. 1922*, pp. 25, 26, 62, 63, fig. 1).—A preliminary test has indicated that soy beans make an excellent forage crop for hogs, 1 acre having produced 400 lbs. of pork. The results of an experiment at the Pee Dee Substation indicate that peanuts and sweet potatoes are not as profitable when used as forage for hogs as they ordinarily are when harvested and sold. Corn and corn and tankage each produced better gains than peanuts or sweet potatoes.

In a study of the relationship of velvet beans to abortion, 9 pregnant sows were divided into 3 lots and fed on the following daily rations during pregnancy: Lot 1, corn meal 55 lbs., wheat bran 20, red dog flour 20, and tankage 5 lbs.; lot 2, velvet bean meal 50 lbs. and corn 50 lbs.; and lot 3, velvet bean meal 75 lbs. and corn 25 lbs. All of the sows farrowed pigs, but the pigs were small and weak from the sows on the velvet-bean rations.

A study of varying planes of protein intake upon growing pigs, T. A. BAKER (*Delaware Sta. Bul. 133* (1922), pp. 10-12).—Eighteen weanling gilts were divided into two lots to compare the effect of different planes of protein intake on growth. The feeds used in the rations consisted of hominy feed, flour middlings, peanut meal, and tankage, which were so balanced that in

one lot the ration had a nutritive ratio of 1:4.8 and agreed with the modified Wolff-Lehmann requirements for these animals, but the nutritive ratio of the ration fed to the other lot of pigs was 1:3.6. Later these rations were modified so that the nutritive ratios were, respectively, 1:5.4 and 1:4.4. The gilts receiving the larger amount of protein made somewhat better gains and were in somewhat better condition at the close of the test.

[**Experimental work with horses at the Missouri Station**], E. A. TROWBRIDGE and D. W. CHITTENDEN (*Missouri Sta. Bul.* 197 (1922), pp. 42, 43, 47, fig. 1).—The results of two experiments in horse production are briefly reported.

Relative efficiency of bred mares for farm work (pp. 42, 43).—In a test lasting one year 3 purebred Percheron mares with foals were compared as to feed consumed, weight maintained, and labor performed with 3 dry mares, each of which were working in a team with one of the brood mares. During the test the brood mares consumed an average of 5,905 lbs. of grain (oats and corn, equal parts) and 7,561 lbs. of hay, as compared with 5,111 lbs. of grain and 7,442 lbs. of hay consumed by the dry mares. The brood mares lost 46 lbs. in weight, while the dry mares lost 12 lbs. The foals of the brood mares were supplied with some additional grain.

Growing draft colts (p. 47).—The 7 Percheron colts from the colt raising test during the previous year (E. S. R., 46, p. 363) were pastured on blue grass through their second summer and third winter period. An average of 5.38 lbs. of grain (corn and oats, equal parts) and 7.95 lbs. of hay was fed daily during the winter. Average daily gains in weight of 0.4561 and 0.51 lb. were made during the summer and winter periods, respectively. Slight gains in height were made during each period.

[**Poultry experiments at the Missouri Station**], H. L. KEMPSTER and E. W. HENDERSON (*Missouri Sta. Bul.* 197 (1922), pp. 75-77).—The experimental results obtained with poultry are briefly reported. Many of the studies are continuations of those noted in the previous report (E. S. R., 46, p. 370).

[*Influence of time of hatching and early maturity on egg production*] (pp. 75, 76).—Among the White Leghorn pullets the early hatched and early maturing pullets were found to be the best producers, as in previous years.

Value of sour milk, beef scrap, cottonseed meal, gluten meal, and oil meal in rations for egg production (p. 76).—When tankage, cottonseed meal, hoof meal, or sour milk were added to a basal ration for laying hens, the average number of eggs produced in the lots receiving the different protein supplements were, with sour milk, 128; with 20 per cent tankage, 113.5; with 15 per cent tankage, 84; with 10 per cent tankage, 86; with 5 per cent tankage, 100; with 15 per cent tankage and 5 per cent cottonseed meal, 88; with 20 per cent hoof meal, 75; with 15 per cent cottonseed meal and 5 per cent tankage, 68; and with 10 per cent cottonseed meal and 10 per cent tankage, 46 eggs.

Age as a factor in poultry breeding (p. 76).—Pullets hatched from eggs produced by pullets and hens were compared as to mortality and total and periodic egg production. The mortality among pullets hatched from pullet eggs was 16.4 per cent, as compared with 11.6 per cent among pullets hatched from hens. The egg production was practically the same in both cases.

Time of molting as an index to past and future egg production (p. 77).—Among a flock of 200 White Leghorns the pullets molting after September 1 were found to be better producers than those molting before September 1, but those birds not showing any signs of molting by November 1 were by far the best producers.

The value of sour milk and beef scraps in rations for growing chicks and the cost of growing chicks (p. 77).—The chicks which had 20 per cent tankage

added to their basal ration weighed 0.285 lb. each at the end of 8 weeks. Other chicks having access to sour skim milk weighed 0.474 lb., and others receiving sour skim milk and eggs weighed 0.544 lb. at the same age. The mortality was, respectively, 12.5, 15, and 15 per cent in the different pens.

Mineral mixtures for growth of chickens and egg production, D. C. KENNARD and P. S. WHITE (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 11-12, pp. 171-178, figs. 2).—Two series of experiments have shown that soy bean or peanut meals may be successfully used as protein supplements for egg production or growth when proper minerals are fed in addition. The gains of White Leghorn cockerels fattened on a basal ration of corn meal and soy-bean meal for 2 and 3 week periods were nearly doubled by the addition to the ration of 3 per cent of mineral mixtures composed of equal parts calcium carbonate, sodium chlorid, and either equal amounts of steamed bone meal, precipitated bone meal, or rock phosphate, or 3 parts of bone ash.

Ten lots of hens and pullets receiving a basal ration of grain consisting of 3 parts corn, 1 part wheat, and 1 part oats, and mash consisting of 2 parts corn meal, 1 part ground oats, and 1 part standard wheat middlings, with the addition of sprouted oats, oyster shells, and grit, laid the following numbers of eggs per bird from November to May in the different lots: When 1 part meat scrap was added to the ration, 76.3, 69.7, and 73; when 1.4 parts peanut meal and a mixture (4 per cent of mash) of 60 per cent bone phosphate, 20 per cent calcium carbonate, and 20 per cent sodium chlorid were added to the ration, 60.7, 54.8, and 76.5 eggs; when 1.4 parts peanut meal were added, 37.2 and 36.7 eggs; when 1 part soy bean meal and the above mineral mixture (2 per cent of mash) were added, 74.9; and when 1 part soy-bean meal was added to the ration, an average of 44.2 eggs.

The experiment indicates that the inferiority of vegetable proteins as compared with animal proteins for poultry feeding is largely due to a lack of minerals.

Baby chick troubles, G. H. POUND (*New Jersey Stas. Hints to Poultrymen*, 11 (1923), No. 5, pp. 4, fig. 1).—This is a discussion of the remedies which have been found to be effective in preventing the more common difficulties encountered in raising baby chicks.

The use of artificial light to increase winter egg production, J. E. DOUGHERTY (*California Sta. Urc.* 254 (1922), pp. 6, fig. 1).—General directions are given for the use of artificial light to increase winter egg production. The main cause of the increased production seems to be in giving the birds a longer time in which to eat and exercise. Artificial lighting is not recommended for breeders.

Light on the hen, C. E. BRETT (*R. I. State Col. Ext. Bul.* 17 (1922), pp. [4]).—The different methods of lighting hen houses are described, and a discussion is given telling how to get the best results with lights.

The correlation between first and second year egg production in the domestic fowl, J. A. HARRIS and H. R. LEWIS (*Genetics*, 7 (1922), No. 3, pp. 274-318, figs. 8).—This is a similar but more thorough statistical analysis of the data previously analyzed (E. S. R., 47, p. 672).

Culling the poultry flock, C. E. BRETT (*R. I. State Col. Ext. Bul.*, n. ser., No. 15 (1922), pp. 8, figs. 5).—Instructions are given telling how and when to select laying hens.

Egg production and costs on New Jersey poultry farms, W. H. ALLEN (*New Jersey Stas. Hints to Poultrymen*, 11 (1923), No. 4, pp. 4).—A tabulated summary of cost accounts kept on 34 New Jersey poultry farms for the year ended October 31, 1922, is given.

Fox ranching in Canada, I, II (*Canada Dept. Agr. Bul. 12, n. ser. (1922), pp. 39, figs. 11*).—This is a description of the management, care, and feeding of foxes in captivity as practiced in Canada.

I. Construction of ranches, management, sanitation, and diseases of foxes, J. A. Allen (pp. 3-27).—The plan of the fox ranch is described, and reference is made to the different diseases and parasites which are more liable to affect foxes in captivity. Plans for the necessary buildings and fences are given.

II. Nutrition and feeding of foxes in captivity, G. E. Smith (pp. 28-39).—The principles of fox feeding are given, as well as a discussion of the deficiency diseases which may occur in foxes.

DAIRY FARMING—DAIRYING.

Influence of age at the time of freshening on production of dairy cows, A. C. McCANDLISH (*Iowa Sta. Research Bul. 73 (1922), pp. 243-255*).—After giving a brief review of previous studies relative to the effect of age on milk and fat production, the author reports a study of all Jersey Register of Merit records to July, 1916, and all Guernsey Advanced Registry records to April, 1916. These 5,772 Jersey and 4,536 Guernsey records were tabulated according to the age of the cows at the time of beginning the records, and the average milk and fat production and fat percentage of the records falling in each yearly class were determined.

The author states that there was an increase in both milk and fat production in Jersey cows up to 8 years of age and in Guernseys to 7 years of age. The fat percentage of the Guernseys was highest for the animals under 2 years of age, with a nearly regular decrease to 10 years of age. The fat percentage of Jerseys showed an increase to 4 years of age, with an irregular decrease to 11 years of age.

In comparing the records of cows of different ages, based on the average 5-year-old production with the Official Advanced Registry entrance requirements, it was determined that 8-year-old Jerseys entered with the greatest margin, though very close agreement was obtained between the relative average records made at different ages and the relative Registry of Merit requirements. In Guernseys the easiest time to enter the Advanced Registry would be for animals from under 2 to 3 years of age, though a very close relationship existed in all cases between the average records and the official requirements. From the results of the study "it would appear that the entrance requirements for the various classes are equitable."

The protein and the maintenance requirements of dairy cattle, J. L. HILLS (*Vermont Sta. Bul. 229 (1922), pp. 3-10*).—This is a popular summary of Bulletins 225 and 226 previously noted (E. S. R., 48, pp. 173, 375).

The nutrient requirements and milk production of cattle and goats.—**The relationship between body and feed utilization**, V. RENNER (*Fühling's Landw. Ztg., 71 (1922), No. 17-18, pp. 335-351*).—A large number of German experiments showing the feed required for milk production by cows of different sizes and breeds have been reviewed. It was determined that in general there is no relationship between body size and economy of feed utilization, though goats and sheep seem to produce milk with more economy of feed than cows.

Growth studies of dairy heifers.—**II, Protein requirements for growing heifers** (*Nebraska Sta. Bul. 184 (1923), pp. 3-18*).—In continuation of the experiments noted (E. S. R., 48, p. 76), studies of the protein requirements of dairy heifers have been carried on. Three pairs of Jerseys varying in age from 11 to 18 months at the start of the test and one pair of Holsteins 9 and 9½

months of age, respectively, were selected according to age and breeding. One animal of each pair was fed a low protein ration containing a little more protein than the minimum requirement of current feeding standards. The ration of the second animal in each pair contained a larger amount of protein derived from the same feeds, but the rations were so balanced that in each case sufficient net energy was supplied to support normal growth without material fattening.

From 11.8 to 12.09 therms of energy were supplied daily per 1,000 lbs. of live weight to the Jersey heifers receiving the high protein ration and from 11.8 to 11.81 therms to the Jersey heifers receiving the low protein ration. The energy of the high and low protein rations for the Holsteins varied, respectively, from 11.8 to 12.7 and 11.81 to 12.7 therms per 1,000 lbs. live weight daily. The nutritive ratio of the high and low protein Jersey rations varied from 1:5.53 to 6 and 1:8.87 to 10.1, respectively, and for the high and low protein rations for the Holsteins from 1:4.66 to 5.5 and 1:8.24 to 9.4, respectively.

The feeds used in making up the rations consisted of alfalfa hay or alfalfa meal, wheat or oat straw, corn meal, linseed meal, peanut meal, sugar, and starch. The rate of growth of the heifers was determined by weekly weights and monthly measurements of the height at withers and hips, width at hips, heart girth, and length of body, a summary of which is given in the following table:

Growth of dairy heifers on high and low protein rations.

Protein plane	Breed.	Length of test	Total gain in weight.	Crude protein consumed per pound gain	Average monthly gain in body measurements.					
					Height at withers ¹	Height at hips ¹	Width at hips ¹	Length of body ¹	Heart girth ¹	Weight ²
		Days.	Lbs.	Lbs.	Cm.	Cm.	Cm.	Cm.	Cm.	Lbs.
High.....	Jersey.....	266	256	2.01	0.87	1.61	1.20	2.53	4.09	51.53
Low.....	do.....	266	201	1.45	.97	.68	.77	3.85	4.17	41.20
High.....	do.....	266	187	2.53	1.07	1.35	1.24	1.79	4.94	36.17
Low.....	do.....	266	208	1.15	1.10	1.49	.99	3.21	4.25	56.36
High.....	do.....	407	383	2.01	1.43	1.21	1.18	2.84	3.95	59.43
Low.....	do.....	407	426	1.05	1.31	1.21	.96	2.16	3.34	72.53
High.....	Holstein.....	252	370	1.53	1.68	1.80	1.27	3.90	3.73	74.76
Low.....	do.....	252	316	1.05	2.30	1.88	1.51	3.40	4.20	70.69

¹ Per 100 lbs. body gain.

² Per 1,000 lbs. live weight.

The high protein group made an average daily gain of 1.84 lbs. per 1,000 lbs. live weight as compared with 2.01 lbs. for the low protein group. The respective protein requirements per pound of gain were 2.02 and 1.17 lbs. From these data the author concluded that an excess of protein apparently reduces the live-weight gains of heifers, but it seemed to have no effect on skeletal development.

Influence of the nutrition of heifers and the age of breeding upon their subsequent development.—Raising calves on milk substitutes, A. C. RAGSDALE and C. W. TURNER (*Missouri Sta. Bul.* 197 (1922), pp. 59, 60, figs. 2).—In continuation of this experiment (E. S. R., 46, p. 371), Jersey and Holstein calves were raised to about 70 days of age, when they were divided into lots and placed on rations containing the same feeds as were used in the previous experiments. These calves made approximately 75 per cent normal growth to six months of age, but by the time the calves were one year old they had attained approximately normal weight.

Feeding dairy steers, G. BOHSTEDT (*Ohio Sta. Bul. 7 (1922), No. 11-12, pp. 193-196, figs. 5*)—A test is reported in which 6 Holstein bull calves were castrated at 11½ months of age and fattened for 154 days on an average ration per steer of 14 lbs. of ground corn, 2.5 lbs. of linseed meal, 4.4 lbs. of hay, and 2.2 lbs. of corn stover. Average daily gains of 2.57 lbs. per day were made. The steers were in poor condition at the start of the test, being valued at \$4.25 per 100 lbs. At the close of the test they sold for \$8.50 per hundred, making an estimated profit over feed cost of \$10.83 per steer.

Six Angus steers 10½ months of age were fed at the same time as a comparative lot. These steers were in better condition at the start of the test and were valued at \$7 per hundred. They were also better finished at the end of the test, selling for \$9.75 per hundred. The average daily gains made, however, were less than in the case of the Holstein steers, being 2.21 lbs., and the profit over feed cost was only \$6.62 per steer. The dressing percentages of the Holstein steers averaged 60 as compared with 61 per cent for the Angus steers.

[Dairy cattle feeding experiments at the South Carolina Station] (*South Carolina Sta. Rpt. 1922, pp. 33-35*).—Two seasons' results in comparing corn and sorghum silage for milk production have indicated that sorghum is about 96 per cent as efficient as corn, pound for pound, for producing milk, and about 97 per cent as efficient for producing butter fat, but only about 88 per cent as efficient as corn silage in maintaining body weight. Since sorghum yields better than corn, it is suggested that sorghum may be the more economical silage crop.

One test with dairy cattle in which the rations consisted of one-fourth, one-half, and three-fourths, respectively, of velvet beans indicated that the rations containing the largest amount of velvet beans were the most economical. Body weight and milk flow were maintained as well with the velvet beans as with other feeds.

Dairy calves receiving pulverized limestone showed greater increases in weight and height than animals not receiving lime. Studies of the mineral requirements of cows are also being carried on.

A study of the effects of feeding inorganic calcium to milking cows, T. A. BAKER (*Delaware Sta. Bul. 133 (1922), p. 12*).—Four cows fed a ration of corn-soy-bean silage and grain containing 3 per cent of pulverized limestone from November to April showed no greater persistency of production than another lot of cows on the same ration without the limestone. Other experiments have failed to show any advantages of feeding calcium.

Dairy cattle feeding experiments with urea, RICHARDSEN and BRINKMANN (*Fühling's Landw. Ztg., 71 (1922), No. 17-18, pp. 325-334*).—The results of three feeding experiments carried on at the Bonn-Poppelsdorf High School, Germany, are reported. The first and second experiments consisted of 5 periods each and the third of 7 periods of 7 days each, with transition periods of 7 days between the experimental periods. The 5 cows in the first experiment and 4 in the second and third received a basal ration composed of beets, oat straw and chaff, linseed and rape-seed cake, and beet pulp, with the addition of 200 gm. of urea per head daily in periods 2 and 4 in experiments 1 and 2 and in periods 2 and 5 in experiment 3. Peanut cake replaced the linseed cake in periods 3 and 6 of the last experiment. The basal ration in each case was so balanced that it contained approximately the required amount of starch equivalent (according to Kellner), but was slightly deficient in protein.

The average amounts of milk produced per day by the cows in the first to fifth periods in the first experiment were, respectively, 7.67, 8.23, 7.15, 7.31, and 6.57 kg., in the respective periods of the second experiment 12.35, 12.3, 11.06,

12.08, and 11.63 kg., and in the first to seventh periods of the third experiment 7.15, 7.72, 7.92, 7.06, 7.82, 7.96, and 6.78 kg.

By comparing the milk production during the periods when the cows received urea with the average of the two closest periods when the cows received only the basal ration, it was determined that there was an average increase during the urea periods of from 1 to 12 per cent. There was also an increase in the fat percentage of the milk of from 3 to 4 per cent during the first and second experiments when urea was fed and of 4 to 8 per cent in the third experiment. The differences in fat yields were thus greater than the differences in milk yield. With peanut cake there was an increase of 2 per cent in the fat percentage in one case, with no increase in the other, which resulted in the amount of fat produced being slightly larger in the periods when urea was fed. The live weights of the animals slightly increased from the first to the last periods in each experiment.

The authors conclude that the three experiments uniformly indicate that increased milk and fat yield may be expected when urea is added to a low protein ration, and that the lower the protein in the ration the greater will be the increase when urea is added.

Comparative expense of mechanical and hand milking, F. A. PEARSON and H. A. ROSS (*Illinois Sta. Bul.* 241 (1923), pp. 491-506).—Detailed cost accounts kept on 66 Illinois dairy farms showed that on 32 farms where 860 cows were kept which were milked by hand the average cost of milking and caring for a cow per year was \$23.44 as compared with a similar cost of \$18.64 on 34 farms where a total of 850 cows were milked with mechanical milkers. The cost of hand milking was determined per cow per year as 133.9 man hours at 17.5 cts. per hour. The comparative cost where mechanical milkers were used was divided up as follows: \$2.46 for power, 57.2 per cent of which was for fuel and 21.4 per cent for depreciation on the engine; \$1.92 for the expenses of a milker, of which 44.8 per cent was for depreciation, 27.6 per cent for repairs, and 24.6 per cent for interest on the milker; and \$14.26 for 81.5 hours of labor.

The costs of mechanical milking were found to be somewhat larger for herds of less than 25 cows, though in these cases the total cost was only increased to \$20.55 per cow. The advantage of the mechanical milker lies mainly in the saving of labor. "These data indicate that the cost of labor is the principal factor determining the relative economy of mechanical and hand milking."

[Changes in the composition of milk and milk products] (*Missouri Sta. Bul.* 197 (1922), pp. 49, 50, 53, 55-57, 58, 59, figs. 2).—The following experiments dealing with the composition of milk and ice cream are briefly reported, most of these being continuations of experiments previously noted (*E. S. R.*, 46, p. 371):

A study of the colostrum with special reference to the effect of heat (pasteurization) on its physico-chemical, bacteriological, immunological, and nutritional changes, A. C. Ragsdale and S. Brody (pp. 49, 50).—Since one lot of calves which was fed on pasteurized colostrum did not do well, a study of the effect of the pasteurization temperature on the time and rate of coagulation of colostrum was made. The respective times required to kill tuberculosis organisms and coagulate the colostrum were determined as follows for various temperatures: 140° F. 20 minutes and 3 hours, 144.5° 18.5 and 30 to 40 minutes, 149° 14 and 10 to 15 minutes, and 158° 3 and 2 minutes.

Factors affecting the normal composition of milk.—Factors influencing the percentage and quantity of fat in the milk of cows on official test, A. C. Ragsdale, S. Brody, and C. W. Turner (pp. 53, 55-57).—In further studies of the factors influencing the percentage and quantity of fat in milk, the effect of

environmental temperature was not so pronounced as was reported in earlier work. Sponging cows with cold water at 2-hour intervals during the day tended to increase the fat percentage and total fat in the nights' milk during the first 3 weeks of this treatment, but no increase resulted from longer treatments. The variation in fat percentage in successive portions of cow's milk has been previously noted (E. S. R., 46, p. 771).

The data dealing with the effect of stage of lactation and seasonal variation on fat percentage are given as in the previous report. In addition, the milk flow of 3,215 Guernseys, 305 Jerseys, and 95 Holsteins was found to increase during the second month of lactation and then gradually decrease until the end of the lactation period. The percentage of total yearly production produced during the first to the twelfth month for Guernseys was, respectively, 10.6, 10.9, 10.3, 9.5, 8.9, 8.4, 7.9, 7.5, 7.1, 6.6, 6.2, and 5.7 for the different months. The Jerseys and Holsteins showed similar results. The season of freshening had a marked effect on production, as cows freshening in the fall or winter months exceeded the average more than cows freshening in the summer and a greater decline in milk flow occurred from June to August than from December to June. The largest total yearly fat yield occurred when cows freshened in November and the least when cows freshened in August.

The effect of each ingredient in the manufacture of ice cream, W. H. E. Reid and D. H. Nelson (pp. 58, 59).—The study of the effect of certain ingredients in an ice-cream mix has been continued. The effects of the different percentages of fat have been similar to those observed in an earlier report. Increased amounts of sugar, skim-milk powder, or condensed or evaporated milk in the mix were found to lower the freezing point of the mix. Gelatin, gum tragacanth, and India gum had no effect on the freezing point.

Bacterial content of milk (*South Carolina Sta. Rpt. 1922, pp. 29, 30*).—(Continuation of the studies of the bacterial content of milk previously noted (E. S. R., 46, p. 771) indicates that where the initial number of bacteria is low there is no marked increase in the milk during the first few hours. Milk from some cows, however, apparently contains more bacteria than milk from other cows. Holstein milk seems to contain less bacteria than Jersey milk. Certified milk production appears to be largely a matter of sterile utensils and cleanliness in milking and handling the milk.

Comparison of A. P. H. A. and milk powder agars, H. F. ZOLLER and S. M. EATON (*Ice Cream Trade Jour.*, 18 (1922), No. 10, pp. 59–61; 19 (1923), Nos. 1, pp. 61–64, figs. 5; 2, pp. 53, 54).—A series of experiments are reported in which comparative plate counts of the bacteria in market milk and ice cream mixes were determined on A. P. H. A. agar and a similar agar to which milk powder had been added. The plates were incubated both at 30° and 37.5° C.

The counts for the same samples of milk were greater in every case with the milk powder agar. Sixty-six comparative counts with market milk in which the incubation temperature was 30° showed that counts on milk agar varied from 1.15 to 11.8 times as great as the counts determined on the A. P. H. A. agar. Very similar results were obtained for market milk when the plates were incubated at 37.5° and for ice cream mixes using both incubation temperatures. Other advantages of the milk powder agar are that peptonizing and acid-forming bacteria behaved more as they would in milk, and that the differences between the two types can readily be observed.

In the third article of the series on the relation of bacterial counts to food control, the senior author advocates a change in the practice of incubating milk cultures at 37.5° to an incubation temperature of 30°, since better growth

seemed to occur at the latter temperature. This is also in conformity with the work of Supplee et al. (E. S. R., 46, p. 274).

Comparison of the use of superheated and unsuperheated condensed skim milk in the manufacture of ice cream. P. H. TRACY (*Creamery and Milk Plant Mo.*, 12 (1923), No. 1, pp. 73, 74, 76, figs. 5; also in *Ice Cream Trade Jour.*, 19 (1923), No. 1, pp. 66-68, figs. 5; *Ice Cream Rev.*, 6 (1923), No. 9, pp. 6, 8, 10, 14, figs. 5).—Experiments to determine the effect of superheating condensed milk on the physical properties of the milk proteins and the resulting effects on ice cream mixes in which the condensed milk was used were carried on at the Illinois Experiment Station. The skim milk was condensed to a Baumé reading of 12.5 at 130° F. and part of it was then superheated to 185-190° with live steam. The viscosity of the condensed milk was increased about 60 times by superheating. This was attributed to a change in the condition of the milk albumin, since albumin from the unsuperheated milk was found to pass through a porous clay filter, but albumin from the superheated milk would not pass through such a filter.

In comparisons between the ice-cream mixes which contained superheated and unsuperheated condensed milk it was found that the superheated condensed milk increased the viscosity of the mix from 27 to 31.3 per cent, depending upon the amount of condensed milk which it contained. A 71.1 per cent overrun was obtained in ice-cream mixes containing unsuperheated condensed milk, whereas superheated condensed milk mixes showed an overrun of 81.7 per cent. The mixes containing the superheated condensed milk showed further advantages in having a heavier body, smoother texture, and more resistance to higher temperature, but the flavor was not as good as when the mixes contained unsuperheated condensed milk.

Sandy ice cream from the production man's angle. R. T. DES JARDINS (*Ice Cream Trade Jour.*, 18 (1922), No. 12, pp. 45, 46).—Four causes of sandy ice cream are briefly cited as the use of products containing either crystallized lactose or a high degree of acidity, an incorrectly proportioned mix, or allowing the ice cream to suffer too great changes in temperature. The best methods of preventing sandiness are to prevent the occurrence of these conditions, but proper pasteurization and aging of the mix will dissolve crystallized lactose which may be present in any of the products and thus prevent many cases of sandiness.

Casein, a by-product with a great future (*Dairyfarmer* [Hamilton, New Zeal.], 3 (1923), No. 5, pp. 27-29, figs. 6).—The varied purposes for which casein may be used include ingredients of paints, glues, imitation ivory, photographic films, insecticide and fungicide sprays, etc. The casein is manufactured by coagulating the casein of skim milk by different methods according to the use for which the casein is designed. The coagulated casein is then dried in ovens, after which it may or may not be ground for marketing.

VETERINARY MEDICINE.

Pasteur and his work. L. DESCOUR, trans. by A. F. and B. H. WEDD (London: T. Fisher Unwin, Ltd., 1922, 2. cd., pp. 256, pl. 1, figs. 2).—This volume, a translation from the second French edition, is said by E. Roux, who was a daily collaborator of Pasteur throughout that period which was most fertile in discoveries, to relate what nobody should be ignorant of in Pasteur's life, and what all who are engaged in scientific work should know of his achievements.

Anatomy and physiology of animals, L.-J. DALBIS (*Anatomie et Physiologie Animales*. Paris: J. de Gigord, 1922, pp. XII+713, figs. 520).—The main part of this work, dealing particularly with the anatomy and physiology of man, is followed by an account of that of the lower animals (pp. 521-613). Synoptic tables, etc., are appended.

Veterinary science, J. W. CONNAWAY ET AL. (*Missouri Sta. Bul.* 197 (1922), pp. 89-94).—Investigations of infectious abortion in cattle and swine conducted during the year, here briefly reported upon, deal with (1) the viability and virulence of the Bang abortion infection in both artificially and naturally infected animals, (2) a study of the conditions of transmission of the infection, and (3) immunity in old and young, and transmission of *Bacillus abortus* antibodies from mother to young. In this work three separate herds of cattle and one herd of swine, comprising a total of 198 cattle and 96 swine, were systematically studied during the year.

Experimental researches on the effects of castration, I. LAMINATI (*Clin. Vet., Russ. Polizia Sanit. e Ig.* [Milan], 44 (1921), No. 21-22, pp. 635-647, figs. 2; 45 (1922), No. 1, pp. 14-30, fig. 1; *abs. in Internatl. Inst. Agr.* [Rome], *Internatl. Rev. Sci. and Pract. Agr.*, 13 (1922), No. 4, pp. 531, 532).—The first of these two papers reports on leucocytic phagocytosis and the second on hematological observations of castrated animals.

Experiments conducted by the author with adult dogs led to the conclusion that castration causes a decrease in the phagocytic index of the leucocytes. The experiments with dogs indicated that castration has no appreciable effect, either quantitative or qualitative, upon the erythrocytes, nor upon the number of the leucocytes, and this applies equally to monolateral and to bilateral castration. (2) The castration of adult animals produces, on the other hand, very noticeable and lasting changes in the relative number of leucocytes, causing a noticeable decrease in the lymphocytes, a moderate diminution in the number of acidophile polymorphonuclears, an increase in the large mononuclears, a moderate increase in the basophile polymorphonuclears, and a conspicuous increase in the neutrophile polymorphonuclears. (3) The effect of castration upon the relative number of leucocytes is more evident in the case of bilateral than of monolateral castration. The results, which manifest themselves very quickly, have a tendency to become permanent. The literature is reviewed, and bibliographies of 18 and 48 titles, respectively, are included.

Laboratory feeding of molds to animals, M. B. CHURCH and J. S. BUCKLEY (*North Amer. Vet.*, 4 (1923), No. 1, pp. 7-12, 15).—The authors find that, while pure cultures of common saprophytic molds are not generally toxic when fed to laboratory animals, the presence of mold in forage or in human food is nevertheless an indication of incipient spoilage. By the extensive feeding of laboratory animals pure cultures of molds common in forage and food products, one and often the obvious factor of forage and food spillage may probably be eliminated from charges of toxicity.

Poisonous properties of *Bikukulla cucullaria* (Dutchman's breeches) and *B. canadensis* (squirrel corn), O. F. BLACK, W. W. EGGLESTON, J. W. KELLY, and H. C. TURNER (*Jour. Agr. Research* [U. S.], 23 (1923), No. 2, pp. 69-78, pl. 1).—This is a report of experiments conducted cooperatively by the U. S. Department of Agriculture and the Virginia Experiment Station. In June, 1920, attention was called to the probably poisonous character of species of *Bikukulla* by H. S. Stahl, who reported that *B. cucullaria* was believed to be responsible for the death of a number of cattle in the mountain pastures of Bland County, Va. As a result of the investigations which followed this species has been shown to contain a poisonous alkaloid hitherto unrecognized, and the toxicity of this plant for cattle has been demonstrated in feeding experiments.

Poisonous alkaloids were also found in *B. canadensis*, but this species is much less toxic than *B. cucullaria* and is not likely to cause any damage to cattle. Chemical examination has shown that both these plants contain toxic alkaloids and that the tops as well as the bulbs of *B. cucullaria* are poisonous. The alkaloid abundant in *B. cucullaria*, hitherto apparently unknown, has been named cucullarin, and its properties are described. The same alkaloid probably occurs in *B. canadensis* also, since its physiological effect on mice closely resembles that of *B. cucullaria*.

The action of some disinfectants on the culture of *Cryptococcus farciminosus*. W. PAMPERIN (*Ztschr. Veterinark.*, 34 (1922), Nos. 4, pp. 103-111; 6, pp. 169-178, figs. 2).—Tests conducted by the author with a view to determining the action of disinfectants on (*C.*) *Blastomyces farciminosus* are reported.

It was found that 1 per cent solutions of carbolic acid, of lysoform, and of formalin destroy the organism after an exposure of one hour. Corrosive sublimate at a strength of 1 to 5,000 also destroys the organism upon exposure for one hour. A 3 per cent solution of antiformin is effective after an exposure of three hours, but lime at a strength of 20 per cent is ineffective under these conditions. Sulphur dioxide gas at a concentration of 18 per cent by volume destroys the organism after an exposure of five minutes. A list is given of 57 references to the literature.

On local and general immunity. F. P. GAY (*Jour. Immunol.*, 8 (1923), No. 1, pp. 1-10).—A presidential address delivered before the American Association of Immunologists at Washington, D. C., on May 1, 1922.

The bacteriophage: Its rôle in immunity. F. D'HERELLE, trans. by G. H. SMITH (*Baltimore: Williams & Wilkins Co.*, 1922, pp. 287, pl. 1, figs. 14).—In the English edition of this monograph the bibliography of the original French edition has been extended, the text brought up to date, and a new chapter added on the nature of the bacteriophage. In this chapter the various theories which have been brought forward by others to explain the phenomenon are discussed and refuted, and the experimental evidence is summarized upon which is based the author's hypothesis that "the bacteriophage is an autonomous organism, an ultramicrobe parasitizing the bacteria."

The transfer of the immunity of a fowl cholera serum horse to its foal. F. GERLACH (*Centbl. Bakt. [etc.]*, 1. Abt., Orig., 88 (1922), No. 1, pp. 39-42).—The blood of the foal of a horse which has been hyperimmunized against fowl cholera to furnish fowl cholera serum was tested for the presence of antibodies against fowl cholera by injecting it subcutaneously into pigeons which had received a fatal dose of a virulent strain of the fowl cholera organism. The first test was made when the foal was about 3 weeks old, and similar tests were made at daily intervals for a week, and then, after an intermission of a week, for several days longer.

The serum when first tested was as strong as that of the mare in its protective qualities, showing that the antibodies present in the mother's serum pass into the fetus through the placenta. After 4 weeks the protective action had diminished to a considerable extent, and 7 weeks after birth the serum no longer furnished any protection, thus indicating that the immunity was of a passive nature.

A theoretical study of the nature of ultramicroscopic viruses. F. W. TWORT (*Vet. Jour.*, 78 (1922), Nos. 566, pp. 283-291; 567, pp. 324-330).—A presentation of the results of studies conducted by the author.

Bibliographic review: Enzymes of microorganisms. S. A. WAKSMAN (*Abstr. Bact.*, 6 (1922), No. 7, pp. 331-360).—This is a bibliographical review of more than 957 titles.

Studies on anthrax infection, W. L. HOLMAN (*Soc. Expt. Biol. and Med. Proc.*, 20 (1922), No. 1, pp. 60, 61).—To throw some light on the question of the portal of entry of anthrax infection, guinea pigs were fed virulent anthrax spores in such a way as to preclude any possibility of their entrance into the circulation through abrasions in the mouth. This was accomplished by filling small gelatin capsules with the cultures and placing the capsules in the back of the throat, when they were promptly swallowed. In no case did the animals acquire the disease, although virulent spores were recovered from the feces at intervals up to the tenth day. Following the subcutaneous injection of the organism death always resulted. It is concluded "that the intestinal tract is not an easy portal of entry for *Bacillus anthracis*, and that healthy susceptible animals can carry virulent anthrax bacilli for a considerable time and by the distribution of the spores in their feces can be a ready means of spread."

Recent progress in experimental foot-and-mouth disease, H. A. GINS (*Centbl. Bakt. [etc.]*, 1. Abt., Orig., 89 (1922), No. 1-3, pp. 159-161).—This is a brief report of experimental work on foot-and-mouth disease conducted by the author with R. Weber and K. Krause. The first point investigated was the course taken by the injected virus in guinea pigs. A large number of guinea pigs received similar doses of virus, and after 48 hours and at succeeding 24-hour periods a single animal was killed and the heart blood, spleen, liver, and adrenals examined for the virus. Discordant results were obtained in that the virus was found in all four places at the end of the second, fifth, and seventh day, in the blood and liver but not in the spleen or adrenals at the end of the third, and in none of the organs at the end of the sixth day. This difference is attributed to the difference in the clinical progress of the disease in the various animals.

It is considered of interest that the virus was obtained in two cases from the fetus, in one two days and in the other five days after the injection of the virus. This is interpreted as indicating that the immune young of an infected mother acquire intrauterine infection, which gives them an active immunity, and that it is not an overflow of immune bodies from the maternal organism that gives them this protection.

Passage of the virus through the guinea pigs has been found to attenuate its virulence for larger animals. It is announced that with this attenuated virus a healthy hog and a calf have been successfully vaccinated against a severe infection proving fatal to a control animal.

An outbreak of trembles or milk sickness, R. GRAHAM and I. B. BOUGHTON (*Vet. Med.*, 18 (1923), No. 1, pp. 31-33).—The author first discusses the relations of milk sickness and trembles, in which reference is made to the literature and particularly to the investigations of Moseley (*E. S. R.*, 18, p. 876) and of Curtis and Wolf (*E. S. R.*, 37, p. 583). They then report upon a spontaneous outbreak of milk sickness in children and trembles in cattle and horses which occurred near Paxton, Ill., during August and September, 1922. The results of the experiments that were conducted, while incomplete, clearly suggest that *Eupatorium ageratoides* in a fresh state as well as the residue of the alcoholic extract and a concentrated watery extract may under certain conditions prove fatal when ingested by susceptible experimental animals.

The piroplasmoses in Indo-China, H. SCHEIN (*Bul. Agr. Inst. Sci. Saigon [Cochin China]*, 3 (1921), No. 9, pp. 269-283, pl. 1; *abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr.*, 13 (1922), No. 1, pp. 88-91).—The author presents a description of the symptoms, course, and etiology of these affections and studies of the various parasitic forms met with in Indo-China.

A comparative study of human grippe and contagious pleuropneumonia of the horse (equine grippe), E. BEMELMANS, trans. by E. M.

OSTRANDER and D. C. BEAVER (*Jour. Amer. Vet. Med. Assoc.*, 61 (1922), No. 6, pp. 647-666; 62 (1922), No. 1, pp. 52-69).—Following an introductory account, studies including the comparative pathology, bacteriology, and epidemiology are reported upon at length. The author concludes that human influenza and contagious pneumonia of the horse are epidemiologically identical.

On the rabicidal property of antirabies serum, S. KONDO (*Jour. Japan. Soc. Vet. Sci.*, 1 (1922), No. 4, pp. 279-290).—A brief report is given of an investigation of the nature of the properties of antirabies serum prepared by repeated injection into rabbits of very small amounts of living fixed virus, the injections being given daily or every other day for about 22 days.

The serum of the rabbit thus hyperimmunized was found to possess marked rabicidal properties, neutralizing in dilutions of 1:10,000 to 1:100,000 the rabic virus in 100 M. L. D. for guinea pigs. Serum from naturally immune animals proved to have rabicidal properties to a lesser degree, while serum from normal animals, with one or two exceptions, had no rabicidal properties.

Tests to determine the practical protective value of antirabies serum were conducted on guinea pigs. The serum was given intravenously, intraperitoneally, or intracranially, and the animals were then injected intramuscularly with 100 M. L. D. of rabies virus suspended in 0.01 cc. of broth. Protection was secured in some but not in all cases.

In vitro, studies of the optimum temperature and time for union of rabic virus with antirabic serum gave values of 37° C. and 2 hours. On heating the serum to 80° for 3 minutes the rabicidal properties were destroyed. A study of the quantitative relation between serum and virus showed that the amount of serum required for neutralizing the virus is in direct proportion to the quantity of virus.

Fatalities in cattle due to the tick *Dermacentor venustus*, E. A. BRUCE (*Jour. Amer. Vet. Med. Assoc.*, 61 (1922), No. 5, pp. 537-539).—The author reports upon cases in which the death of 2-year-old heifers in British Columbia resulted from paralysis caused by *D. venustus*.

A contribution to the biology of *Trypanosoma equiperdum*, E. IWANOW, (*Parasitology*, 14 (1922), No. 3-4, pp. 315-319).—Experiments with a dog infected with *T. equiperdum* were conducted by the author, who is director of the central experiment station for the breeding of domestic animals at Moscow. These experiments have shown that this trypanosome does not pass into the sperm even at the period of the highest development of the disease.

A case of sleeping sickness (*Trypanosoma gambiense*) treated by "Bayer 205," J. W. W. STEPHENS and W. YORKE (*Ann. Trop. Med. and Parasitol.*, 16 (1922), No. 4, pp. 421-424).—As a result of treatment with this drug the general condition of the patient rapidly improved, the weight steadily increased, and trypanosomes could no longer be found in the blood.

Bovine actinomycosis, its pathogenesis and treatment by vaccines, W. M. SCOTT (*Brit. Med. Jour.* No. 3233 (1922), pp. 1162, 1164).—This discussion of the subject has been summarized by the author as follows:

"The bacteriology of the group Actinomyces is most complicated and unsatisfactory, giving ample scope for the joint action of human, comparative, and plant pathologists. If the parasite does lead a separate existence outside the animal tissues its haunts and habits should be investigated, for until this point is cleared up preventive measures must ever be empirical. How the salts of iodine act therapeutically in cases of actinomycosis is an interesting field for speculation, and possibly by investigations carried out along these lines other sidetracks in the large field of chemical therapy might also be discovered. Although the clinical data of actinomycosis are generally based upon an even and more or less regular plane, the same observation can not

be applied to the *causa causans*, this latter being most diverse and confusing. It must be confessed, however, that cases are seen in practice occasionally which simulate actinomycosis and are not so, save in macroscopical appearances only. Vaccine therapy is a valuable adjuvant in the therapeutics, virulent antigens giving by far the best and most uniform responses."

The diagnosis of bovine infectious abortion by means of agglutination and microscopic studies, L. DETRE and N. ROHONYI (*Berlin. Tierärztl. Wchnschr.*, 38 (1922), No. 30, pp. 345-347).—The agglutinating values of the sera of 52 cattle in a herd badly infected with contagious abortion were compared with the results of the microscopical studies of vaginal smears from the same animals.

Abortion bacilli were found more or less abundantly in 36 of the 52 cases. Of the 16 negative specimens, 11 gave positive agglutination tests, thus making a total of 47 cases of infection as determined by the two tests. The failure of the agglutination test in 28 cases in which positive results were obtained in the bacteriological examination is considered to indicate that the test alone is not trustworthy. A combination of the two tests is recommended as most satisfactory.

Of the 16 microscopically negative cases, 5 gave an agglutination titer below 200 and 11 above, and of the 36 microscopically positive cases, the agglutination titer was below 200 in 28 and above in 8 cases, thus indicating that the more extensive the tissue infection the higher the number of infectious organisms and the lower the agglutination value. This is thought to indicate that in the infected animal the various stages of progress are multiplication of pathogenic organisms, antibody formation, antibody fixation, and death of the organism, this cycle being repeated again and again, until the disease process comes to a standstill.

An outbreak of contagious abortion in an Irish dairy herd, F. J. CRAIG and D. KEHOE (*Jour. Compar. Path. and Ther.*, 35 (1922), No. 4, pp. 256-273).—Investigations of an outbreak which first occurred in Ireland in 1919 are reported upon in detail.

The specific identity of *Bacillus paratuberculosis*, H. R. SEDDON (*Jour. Compar. Path. and Ther.*, 35 (1922), No. 4, pp. 275-280).—In continuation of studies previously noted (*E. S. R.*, 49, p. 181), the author has found "(1) that *B. paratuberculosis* produces a true toxin, i. e., a soluble exotoxin obtainable by filtration, causing symptoms only after a definite period of incubation, and capable of inducing the formation of an antitoxin; (2) that, though the toxins of *B. paratuberculosis* and of *B. botulinus* are identical in their action, the antitoxin to the one does not protect against the other, and vice versa. (3) As it has been shown previously that *B. paratuberculosis* differs from *B. botulinus* (Types A and B) both morphologically and culturally, and it is now demonstrated by toxin-antitoxin tests to be distinct, the specific identity of *B. paratuberculosis* is claimed."

Paratyphoid of the calf, F. KARSTEN (*Der Paratyphus der Kälber*. Berlin: Richard Schoetz, 1921, pp. IV+109, figs. 20).—This is a monographic account intended for veterinarians and students of comparative medicine. It includes a bibliography of 71 titles.

Considerations on the life history of tapeworms of the genus *Moniezia*, F. W. FLATELY (*Parasitology*, 14 (1922), No. 3-4, pp. 268-281).—The author finds that lambs contract *Moniezia* infection either at or very soon after birth. "The intermediate host, if such exists, must be frequent on the pasture in early spring, otherwise lambs would not be found to harbor adult tapeworms so regularly or in such numbers when slaughtered in early summer. In the small intestine of a lamb from 8 to 4 months old slaughtered at Aberystwyth

there occurred 75 individuals. The fact that lambs regularly harbor adult tapeworms before they are weaned suggests the possibility of their contracting the infection from the mother ewes. No direct evidence in this direction has been obtained, however, and an attempt to produce a larval stage in the udder region of a ewe by feeding to it the eggs of a tapeworm proved abortive. . . .

"The invertebrates which seem most likely to harbor an intermediate stage are coprophagous insects, etc. (beetles, flies, mites). Attempts to infect species of *Aphodius* have nevertheless proved fruitless. Moisture favors the survival of the eggs of *Monilezia*; eggs kept in water for a period of several months seemed to remain perfectly viable. Nevertheless, tapeworm is common among flocks on pastures about Rome which are characteristically dry. A comprehensive series of experiments under conditions of the most complete control would almost certainly clear up the life history; on economic grounds alone the problem is urgent. The overwhelming majority of a quantity of worms collected from slaughterhouses in Aberystwyth, Aberdeen, Beaulieu (Inverness-shire), and Newcastle upon Tyne proved to be of the species *M. expansa*. The only other species found were *M. trigonophora* and *M. alba*. The identification was based on anatomical characters and not on externals, which are useless. The writer intends directing his attention to coprophagous mites as carriers, namely, *Gamasus colcoptratorum*, *G. fimetorum*, *Macrocheles glaber*."

The paper includes a bibliography of 19 titles

The kidney worm of hogs in New South Wales, *Sclerostomum renium* n. sp., J. DRABBLE (*Jour. Compar. Path. and Ther.*, 35 (1922), No. 4, pp. 302-305, fig. 1).—The author here describes the so-called "kidney worm," which has been a rather common parasite of pigs in New South Wales, where it has been mistaken for *Stephanurus dentatus*, as representing the new species *S. renium*. This worm is most frequently found in diverticula of the ureters, and it is also commonly found in the pelvis of the kidney, in the kidney fat, and in the liver. Less commonly, but not infrequently, they invade the substance of the kidneys and the sublumbar muscles. Up to within a few years this parasite has been mainly confined to large breeding sows and old boars, but it has now become of considerable economic importance because of its infestation of pigs.

The vitality of trichinae in American bacon and hams, E. SÜSSKIND (*Arch. Hyg.*, 90 (1921), No. 6-8, pp. 336-344; abs. in *Jour. Amer. Vet. Med. Assoc.*, 62 (1922), No. 3, p. 368).—Feeding experiments with guinea pigs have shown that the trichinae in heavily infested and well-salted American hams and bacon are dead and harmless even if their capsules do not show calcareous infiltration. None of the hams and bacon showed calcified trichinae. Studies of the effect of sea salt on muscle trichinae are reported. Extended investigations of this subject by Ransom and his associates have been noted (E. S. R., 44, p. 79).

Clinical observations and experimental investigations of enzootic meningoencephalomyelitis of the horse: Borna disease, R. MOUSSU (*Rev. Méd. Vét.*, 98 (1922), No. 17, pp. 499-511, figs. 2).—Clinical observations and experiments reported by the author have shown the virus to be transmissible to the rabbit, and have led to the conclusion that this disease belongs to the group of affections caused by a filterable virus. It is not a cerebrospinal meningitis but at least an encephalitis and probably a meningoencephalomyelitis.

Experiments in the treatment of canine distemper with neosalvarsan, MOTOS, O. PUBICESCO, and SACHELAIRE (*Vet. Med.*, 18 (1923), No. 2, pp. 142, 143).—The authors find that doses of neosalvarsan of from 0.75 to 1.5 grains are well supported by dogs affected with distemper. No symptoms of intoxication have been observed. In the septicemic forms the temperature begins to

fall six hours after intravenous injections. Four to five hours after the injection a marked amelioration of the symptoms is followed by cure, and it remains to be determined whether an animal once cured can be reinfected. They have never obtained any amelioration with these remedies in grave cases complicated with chorea, paralysis, and gastroenteritis, and only once in broncho-pneumonia.

The respirations of fowls, B. F. KAUPP (*Vet. Med.*, 18 (1923), No. 1, pp. 36-40, figs. 5).—This is a report of studies at the North Carolina Experiment Station of the respiration of the hen, turkey, goose, and duck. It was found that the average length of breath of these four classes of domestic fowl is always shorter in the female than in the male. The greatest differences in length of the breath between female and male of the same class occur in fowls and ducks.

"The number of respirations per minute was determined on 123 adult fowls, of which 12 were cocks and 111 were hens. These data indicate that the very large lymphatic type or more sluggish birds, as the Brahma, breathe much slower than the medium size birds. In this case the average number of respirations per minute for Brahma hens is 28.6, or an average of 8 below the average of all. The males consistently breathe slower than the females. In no case did the respirations run as high as 30. The average number of respirations per minute, as here recorded, for adult cocks is approximately 20. The average number of respirations of the adult hens is approximately 36."

The wandering of ascaris and other nematode larvae in the body, and intrauterine ascaris infection, F. FÜLLEBORN (*Arch. Schiffs u. Tropen Hyg.*, 25 (1921), No. 5, pp. 146-149, fig. 1).—In continuation of previous investigations (E. S. R., 47, p. 284), the author has found that a great majority of the larvae of *Ascaris lumbricoides* which escape from eggs in the gastrointestinal tract reach the liver by way of the portal vein and not through the abdominal cavity, being found in large numbers in the liver and in small numbers in the lungs of guinea pigs as early as four hours after ingestion of the eggs. They pass from the liver to the lungs by way of the hepatic vein, and not through the diaphragm as reported by Yoshida (E. S. R., 42, p. 75). Strongyloids and ascaris larvae reach the kidneys, brain, muscles, etc., through the general circulation.

RURAL ENGINEERING.

[Agricultural engineering at the Missouri Station] (*Missouri Sta. Bul.* 197 (1922), pp. 35, 36).—Studies conducted by J. C. Wooley on methods of prolonging the service of wood fence posts are briefly presented. Seven series of treatments were tested. These included setting without treatment, setting in gravel without treatment, charring the butts to a height of 36 in., painting with hot carbolineum to a height of 36 in., painting with two coats of hot creosote, immersion in boiling creosote for two hours followed by immersion in cold creosote for two hours, and immersion in hot and cold creosote for five hours. The last two treatments gave by far the best results over an 8-year period. Setting the posts in gravel without treatment gave better results than charring the butts and setting in soil, and one coat of hot carbolineum apparently was more effective than two coats of creosote. The common woods tested are divided into four classes of post timber. The first or best class includes white cedar, catalpa, Osage orange, and black locust; the second class, the oaks, white walnut, and honey locust; the third class, black walnut, hickory, sassafras, black ash, hackberry, the elms, and dogwood; and the fourth class includes the more common softwoods.

Investigations on the cost of cultivating corn with a motor cultivator, by M. M. Jones (*E. S. R.*, 46, p. 385), showed that the amount of fuel used per acre was 0.735 gal., the amount of oil 0.1 quart, and the average time required 42.1 minutes.

A study by Wooley on the fuel required for charging a 90-ampere-hour storage battery showed that with gasoline as fuel the cost was 11 cts. and with kerosene 4.9 cts. per kilowatt hour. A comparison of a small water tank system with a large storage tank system showed that the former cost about 5 cts. and the latter about 2 cts. per 100 gal.

Proceedings of the thirty-fourth annual meeting Iowa Engineering Society held at Sioux City, Iowa, January 17-20, 1922 (*Iowa Engin. Soc. Proc.*, 34 (1922), pp. 117, figs. 10).—These proceedings contain among others special papers on The Principles to be Used in Making Benefit Assessments in Flood Protection Districts and Drainage Districts, by C. H. Young; Gravel Road Construction, by J. F. Reynolds; and Maintenance of Gravel Roads, by A. H. Cunningham.

On a new method of gauging the discharge of rivers, J. JOLY (*Roy. Dublin Soc. Sci. Proc.*, n. ser., 16 (1922), Nos. 35-39, pp. 489-491).—This is a brief description of the application of the principle of chemical hydrometry to the measurement of the discharge of rivers. It is stated that very accurate results have been obtained by this method, the error being reduced to below 1 per cent. The method is considered to be superior in accuracy to weir measurements and very much superior in accuracy to measurements based on current meters.

Surface water supply of Canada: St. Lawrence and Southern Hudson Bay drainage, S. S. SCOVIN. (*Canada Dept. Int., Water Power Branch, Water Resources Paper No. 34* (1922), pp. 100, pl. 1, fig. 1).—This report presents the results of measurements of flow made on streams in the Hudson Bay, Lake Superior, Lake Huron, Lake St. Clair, Lake Erie, Lake Ontario, and Ottawa River drainage basins during the climatic year ended September 30, 1921.

Measurement of irrigation water on the farm, H. A. WADSWORTH (*California Sta. Circ. 250* (1922), pp. 36, figs. 17).—Tabular data and formulas necessary for the measurement of irrigation water under the varying conditions found in California are presented and discussed in this circular, together with descriptions of various devices.

It is stated that the common devices in California include rectangular, Cipolletti, and triangular weirs, submerged orifices with fixed and adjustable openings, various miner's-inch boxes and hydrants, and numerous mechanical devices. Weirs are considered to be the most satisfactory for use where the water to be measured is free from silt and where the grade of the ditch is sufficient to allow for the required backing up of the stream. A triangular or V-notch weir is the most accurate for small heads of water and a rectangular for larger heads. A submerged orifice is considered the most satisfactory measuring device if the ditch grade at the required point of measurement is flat, or if the water to be measured is heavily charged with silt.

Some ways of increasing the duty of irrigation water, W. L. POWERS (*Soil Sci.*, 14 (1922), No. 5, pp. 377-382, figs. 2).—In a further contribution to the subject from the Oregon Experiment Station (*E. S. R.*, 37, p. 84) some additional data bearing on a few of the chief ways of increasing the duty of irrigation water are presented. Graphic data from field tests are given showing the usable water capacity of different classes of soils. It was found in experiments that a 3-year rotation receiving manure under irrigation increased the net profit more than a similar rotation without manure during a 9-year period. The yield and net profit per acre inch of irrigation water were almost doubled

by the rotation and manure, and the water requirement per pound of dry matter was reduced nearly one-half by these treatments.

Tank experiments to determine the water requirement of oats grown on two soils with different fertilizer treatments showed that a fertile soil had moderate variations in water requirements with the different treatments, while a soil of medium fertility had a striking difference in yield and water requirement. This is taken to indicate that the richer and better balanced nutrient solution results in a lower water requirement.

It is stated that "the irrigation requirement and water requirement will vary somewhat with the season and anything which affects the evaporation, percolation, or transpiration of soil moisture. Anything that contributes to good irrigation farming, such as planting, irrigating, or cultivating at the right time, tends toward economical use of irrigation water."

Triennial review of irrigation in India, 1918-1921 (*India Pub. Works Dept., Irrig. India, Trien. Rev., 1918-1921, pp. VIII+222, pls. 19, figs. 103*).—In part 1 of this review a brief description is given of the circumstances which render irrigation necessary in India, of the various classes of works by which this irrigation is effected, and of the results achieved and the policy governing the administration of the subject. Part 2 deals with the operations of the triennium under review. Part 3 contains a chronological history of State irrigation in India from its commencement up to the present day. A chapter is included dealing with navigation canals.

Cost of stumping land, S. H. STARR (*Georgia Coastal Plain Sta. Bul. 1 (1921), p. 6*).—Data are presented on the cost of removing the stumps from 70 acres of cut-over land having from 60 to 130 stumps per acre. The direct costs per acre exclusive of overhead expenses amounted to \$13.25.

Manual of reinforced concrete, C. F. MARSH and W. DUNN (*London: Constable & Co., Ltd., 1922, 4. ed., rev. and enl., pp. XVI+504, pls. 9, figs. 198*).—This is the fourth revised edition of this handbook. It contains sections on materials; construction; waterproofing; loads, bending moments, and shearing forces; calculations; and general information, tables, and diagrams.

Some generalizations on the influence of substances on cement and concrete, J. C. WITT (*Philippine Jour. Sci., 21 (1922), No. 4, pp. 365-371*).—In a second contribution to the subject (*E. S. R., 42, p. 581*) studies on the effect of 11 salts on the setting time and tensile strength of four different cements are reported. The cements were used in 1:3 standard Ottawa sand briquets which were stored in water and broken at the end of 7, 28, and 180 days, 1 year, and 5 years. Each test was made in triplicate comprising 2,700 tests.

All four cements when gauged with water alone showed a decrease in tensile strength between the 1 and 5 year periods. The general effect of the various salts was to lower the tensile strength, usually less than 50 lbs. In some cases there was an increase in tensile strength, and the results are not sufficiently regular to permit any definite conclusions as to the relative effects of the different ions present. A comparison of the chemical analysis of the four cements offered no clue as to why one of the cements suffered the greatest loss in strength.

The results are taken to indicate that in general, in the case of concrete at least, ordinary inorganic substances are less likely to affect the strength of cement when they are used in the mixing water than when present in water to which hardened concrete is exposed.

A practical treatise on suspension bridges, D. B. STEINMAN (*New York: John Wiley & Sons, Inc., London: Chapman & Hall, Ltd., 1922, pp. VIII+204, pls. 2, figs. 60*).—This is a handbook of information for practicing engineers

on the design, construction, and erection of suspension bridges. It contains chapters on stresses in suspension bridges, types and details of construction, typical design computations, and erection of suspension bridges. Design charts are appended.

Resistances to the translation of motor vehicles, T. R. AGG (*Iowa Engin. Expt. Sta. Bul. 64* (1922), pp. 32, figs. 18).—This progress report covers the methods and results of an investigation begun in 1919 on the subject of road and vehicle resistance, and deals in part with comparative studies of known methods of measuring so-called tractive resistance.

The space-time recorder has been found to offer a dependable and practical method of measuring resistance to translation, and one which is particularly useful in detecting small differences therein. The results indicate that the term "tractive resistance" should be discarded, and that the resistances to translation be indicated by rolling, air, transmission system, and engine resistances.

It has been found that the rolling resistance is probably less than 25 lbs. per ton of weight of the vehicle for good paved surfaces and good tires, but for low-grade surfaces it may reach 100 lbs. per ton. The results to date are taken to indicate that rolling resistance is about half of the total resistance to translation when a motor vehicle with good tires is operated on hard, smooth road surfaces, and that the resistance due to impact is very small on such surfaces. It is considered to be equally apparent that resistance due to impact may become a significant factor if the road surface is poorly finished or becomes rough through inadequate maintenance, and that also a high toll in fuel bills is exacted by low-grade surfaces. The results of a few fuel-consumption tests of a comparative nature are also included.

It is stated that this study is to be continued in cooperation with the Bureau of Public Roads, U. S. D. A.

The pressures developed in gaseous explosions, W. T. DAVID (*Engineering [London]*, 114 (1922), No. 2974, pp. 791, 792, figs. 7).—A series of pressure curves prepared from records made with an optical indicator with a high-frequency spring, indicating the pressures developed in a cylindrical cast-iron explosion chamber with flat ends by the explosion of coal gas, are presented and discussed.

With a mixture of 15 per cent of gas and 85 per cent of air, it was found that when the spark was placed in the center of the vessel the time of explosion was less and the maximum pressure developed was greater than in the case where the spark was placed near one end of the vessel. In the former case the time of explosion was 0.05 second and the maximum pressure 105 lbs. per square inch above atmospheric, and in the latter case the time of explosion was 0.075 second and the maximum pressure 100 lbs. per square inch above atmospheric. The greatest maximum pressure was clearly developed when the spark was placed in the center of the vessel.

In studies of the effect of strength of the gaseous mixture it was found that with a 15 per cent mixture a maximum pressure of 105 lbs. per square inch was developed in 0.05 second; with a 12.5 per cent mixture a maximum pressure of 90 lbs. per square inch was developed in 0.075 second, and with a 10 per cent mixture a maximum pressure of 76 lbs. per square inch was developed in 0.14 second. The 15 per cent mixture required practically the whole of the oxygen in the air for its complete combustion. The weakest mixture of this coal gas which would ignite on passage of the spark contained between 7 and 8 per cent of coal gas. Similar data relating to hydrogen mixtures are presented.

In studies of the effect of density of mixture the time of explosion increased slightly with the density. Also the ratio of the maximum absolute pressure to the initial pressure increased slightly with the density.

Studies on the effect of the nature of the interior surface of the explosion chamber on pressures developed showed that the maximum pressure was about 3 per cent greater and the rate of cooling much slower where the interior surface was polished than where it was blackened. The presence of inert carbon dioxide was found to reduce greatly the maximum pressure developed and to slow down the speed of combustion.

Air filters for motor-driven agricultural machines, MELDAU (*Tech. Landw.*, 3 (1922), No. 12, pp. 294-297, figs. 23).—Different types of air cleaners for agricultural motors are described and discussed, and the details of some are diagrammatically illustrated to indicate the principles of their operation. Graphic test data are included.

It is concluded that an air cleaner must be accessible and at the same time easily adapted to the construction of the motor. The best results have been obtained with metal filters with or without oil membranes.

Tractor situation in Alabama, M. L. NICHOLS and J. W. RANDOLPH (*Alabama Sta. Circ.* 46 (1922), pp. 7, fig. 1).—A summary of a tractor survey in the State of Alabama, consisting of 125 replies to questionnaires sent to tractor owners, is presented in this report.

Tabular data are given indicating that size of farm is not necessarily the most important factor in determining tractor profits or losses. All farms under 50 acres reported that tractors used thereon were profitable. Reports from farms of from 100 to 150 acres indicated that these sizes are just as profitable as farms of from 500 to 1,000 acres for tractor farming. The 2-plow tractor was the most popular size. The results of an analysis of the sizes of tractors used are taken to indicate that Alabama tractors are not generally overloaded.

The number of acres plowed by each tractor during 1920 varied from 10 to 600. The data indicate that with increased power many farmers in Alabama are working more of their land, instead of substituting power for mules. It is noted that questions dealing with lubrication, cooling, etc., were answered so vaguely as to make the results impossible of tabulation. It is concluded that Alabama stands in about the same position as the Northern and Middle Western States as regards percentage of profitable and unprofitable tractors.

The present status of mechanical soil tillage in Java, C. E. VAN DER ZYL (*Arch. Suikerindus. Nederland. Indië, Meded. Proefsta. Java-Suikerindus.*, 1922, No. 4, pp. 155-193, figs. 6).—This is a rather detailed summary of the results of different experiments on the mechanical tillage of rice and sugar-cane soils in Java, dealing particularly with tractor and cable-drawn plows, plowing v. trenching, and the relation between the period of planting and soil cultivation.

It has been found that in trenching, mechanical tillage saves time, but no time is saved in straight plowing, since the soil must be allowed to dry for about eight days before it can be harrowed and finally prepared for planting. Trenching has been found to be preferable to plowing in heavy soils, although a great drawback of trenching in wet soils with tractors is the slipping of the caterpillar. For this reason cable outfits have given better results than tractors.

It is generally concluded that motor cable outfits and trenching machines give the best results in the tillage of Java sugar-cane soils.

Outline of a study of mechanical cultivation, J. VAN DER POEL (*Meded. Delb. Proefsta. Medan*, 2. ser., No. 24 (1922), pp. 52-64, pls. 11).—This is a brief, systematic description of mechanical cultivating outfits, including cable plows, tractor-drawn plows, combined motor plows, and motor cultivators, and motor scarifiers and pulverizers.

Utilization of electricity and coal for threshing, TAEGEN (*Fühling's Landw. Ztg.*, 71 (1922), No. 11-12, pp. 226-232).—The results of a test made in December, 1921, to compare the costs of threshing by electric motor and steam tractor are briefly reported. The thresher used was equipped with self-feeder and straw press and had a threshing cylinder 1,680 by 620 mm. (about 66 by 24 in.). A 40 h. p. motor of recent manufacture was compared with a 13-year-old 22 h. p. steam tractor using soft coal for fuel. The electric motor threshed an average of 8,360 lbs. of rye grain with an energy consumption of 0.452 kw. hour, while the steam tractor required 2.38 lbs. of coal to thresh 220 lbs. of rye grain. Considering costs of lubricating oil, attendance, depreciation, interest, etc., the cost of threshing by electricity in this test was about twice as great as that of threshing by steam tractor.

The natural basis for the use and sale of agricultural machines in the Rhine Province, VOBMFELDE (*Tech. Landw.*, 3 (1922), No. 4, pp. 77-80, figs. 4).—Statistical data on sizes of farms, cultural practices, and machinery used therefor in the Rhine Province of Germany are presented and discussed in this article. It is stated that only about 300 farms in the Province are of more than 100 hectares (247 acres), while nearly half of the agricultural area is made up of farms of from 2 to 20 hectares. The use of tractors and motor plows is therefore quite limited. Hand and animal operated implements of the simpler type adapted to a more or less intensive agriculture are apparently mostly used.

Recent farm building layouts [in the Rhine Province], D. SPECKMANN (*Tech. Landw.*, 3 (1922), No. 4, pp. 84, 85, figs. 3).—Plans showing recently developed schemes in the arrangement and location of farm buildings on average sized farms in the Rhine Province, Germany, are presented and discussed.

New Jersey poultry buildings, W. C. THOMPSON, W. P. THORP, JR., and G. H. POUND (*New Jersey Stat. Bul.* 370 (1923), pp. 56, figs. 39).—This bulletin supersedes a previous one by Lewis and Thompson dealing with laying and breeding houses (*E. S. R.*, 41, p. 385). It summarizes the essential factors and principles to be observed in the planning and construction of poultry houses and gives the most recent information regarding the New Jersey multiple unit laying houses and suburban unit house, incubator cellar, feed house, and the New Jersey multiple brooder house. Trap nests, hoppers, electric lighting, and miscellaneous equipment are also dealt with. Numerous detailed drawings and bills of material are included.

The adaptable poultry house and equipment, D. C. KENNARD (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 11-12, pp. 201-212, figs. 9).—General information and working drawings for a poultry house adaptable to the various seasons of the year and its equipment, including roosts, wall nests, dry-mash feeders, watering devices, catching crates, and fattening crates are given.

Ventilation of rural buildings, M. LALLIÉ (*Vie Agr. et Rurale*, 21 (1922), No. 48, pp. 406-410, figs. 8).—Four French types of aspirator for use as an accessory part of the ventilating system for farm outbuildings are described and diagrammatically illustrated, and tabular data covering the range of their utility are presented. These represent two distinct types of aspirator, one in which the current of air or wind enters and leaves horizontally, producing a suction influence upon the air in the ventilator, and the other in which the wind current enters at an angle and eventually becomes parallel with the movement of the column of foul air in the ventilator.

The destruction of tubercle bacilli in sewage by chlorin, J. M. and B. B. CONBOY and A. T. LAIRD (*Amer. Rev. Tuberculosis*, 6 (1922), No. 1, pp. 63-68).—Studies of the effluent from an Imhoff sewage tank receiving the sewage from a tuberculosis sanatorium to determine the frequency with which tubercle

bacilli are present in the effluent and the practicability of destroying them with chlorin are reported.

Samples of the effluent taken as it came from the Imhoff tank were found to contain nearly always living tubercle bacilli. A chlorin machine was found to be a practical means of ridding such sewage of tubercle bacilli. It is concluded that two machines should be used to insure continuous disinfection. Preliminary treatment of the sewage is considered to be necessary to reduce it to a liquid form and to prevent the floating of solid particles containing tubercle bacilli in water courses.

RURAL ECONOMICS AND SOCIOLOGY.

A survey of rural economics through the ages, A. DELOS (*Ann. Gembloux*, 28 (1922), No. 12, pp. 389-417).—This is an historical survey attempting to cover the subject as set forth in early Roman literature through that of the Middle Ages, principally the writings of Charlemagne and later French students down to the period of the Physiocrats and modern authors.

The relation of farm management and marketing to economics, G. F. WARREN (*Jour. Farm Econ.*, 4 (1922), No. 3, pp. 152, 153).—It is held that no applied science can be confined to the limits of any one elemental science, and in the judgment of the author the term agricultural economics will tend to disappear, although farm management, marketing, and similar subjects will use economics, mathematics, and other subjects in the development of the work. A thorough study of one farm business should precede generalization about farming.

Rural life (*Missouri Sta. Bul.* 197 (1922), pp. 78-81).—The following studies are briefly reported upon:

Utilization of labor on the farm, O. R. Johnson.—Data are supplied in greater detail for the study noted from the preceding report (*E. S. R.*, 46, p. 387). The labor requirements are tabulated by principal operations under the heads of hours per acre and percentage of time saved.

Cost of producing beef in Missouri, O. R. Johnson and B. H. Frame.—The results of feeding cattle on 24 Missouri farms for the season 1920-21 are tabulated, the cattle being grouped according to the receipts per \$100 worth of feed fed. The two factors definitely influencing profits appear to have been the margin between the buying and selling price and the average daily gain.

Cost of producing farm products under farm conditions, O. R. Johnson and B. H. Frame.—A summary is given of a bulletin abstracted earlier (*E. S. R.*, 47, p. 192). The average costs of producing milk per cow and per 100 lbs. of milk on 16 farms during the year 1918 are also tabulated.

The agricultural and market value of Missouri farm lands, O. R. Johnson.—An investigation covering approximately 3,000 farms in seven counties and going back to the year 1823 is noted here.

Rural training laboratory, O. Howells.—A brief note is made of the progress of a project for assisting rural communities and affording students in training the opportunity of observing or participating in community activities.

Cost of family living on the Missouri farm, O. R. Johnson and B. H. Frame.—Expenditures for groceries, dry goods, and miscellaneous items and the total outlay on 10 farms in 1920 and on 8 in 1921 are tabulated.

Interdistrict farm competition for the mallee, H. A. MULLETT (*Jour. Dept. Agr. Victoria*, 20 (1922), No. 8, pp. 449-471, figs. 18).—The farms of nine competitors qualified for entry in the Royal Agricultural Society's third competition (1921-22) were scored on a scale, 25 per cent of the points in which were given for the farm considered as a business.

Farm record keeping and the application of business principles to farming, M. R. BENEDICT and H. D. McCULLOUGH (*S. Dak. Agr. Col. Ext. Circ.* 39 (1922), pp. 22, figs. 2).—This discussion covers briefly some of the means the farmer may adopt to increase his gross income. Pages are reproduced from a South Dakota farm business record for 1921.

An erroneous method of calculating depreciation, G. F. WARREN (*Jour. Farm Econ.*, 4 (1922), No. 3, pp. 154, 155).—The approved method of estimating depreciation by dividing the cost by the probable number of years of use is deemed erroneous, since depreciation decreases as the machine gets older and repairs increase with use.

Report on dairy control and cost accounting groups for 1920-21, K. SAAREIM ([Norway] *Landbr. Direkt. Beret.*, 1920-21, Tillegg O, pp. 38).—Detailed reports and summaries by Provinces are given from the records of a number of cost-accounting projects in Norway.

The dairy cow as a market for labor, W. L. CAVERT and G. A. POND (*Minn. Agr. Ext. Spec. Bul.* 64 (1922), pp. 8, figs. 2).—Data are compiled from records collected in 1920 on the Owatonna statistical route in Steele County, Minn. (*E. S. R.*, 47, p. 392).

Marketing Vermont maple sap products, A. W. MCKAY (*Vermont Sta. Bul.* 227 (1922), pp. 3-48, figs. 8).—The demand for Vermont maple sugar and sirup is said not to have kept pace with the population, and at the present time at least two-thirds of the Vermont production is sold in bulk and used for flavoring purposes. For this reason the products have been sold at low prices, except during periods of cane sugar scarcity, and the tendency has been to pay less attention to quality.

Two cost of production studies are referred to, one of which has been noted (*E. S. R.*, 38, p. 414). The other was made in 1921 by M. P. Rasmussen and summarized 60 reports on records kept by farmers. It is shown that the average cost per gallon was \$1.52, of which man labor constituted 36 per cent, wood for fuel 16, interest on the average investment in equipment 13, depreciation on equipment 12, horse labor 10, interest on the average investment in the sugar bush 5, and repairs 1 per cent. These data were obtained in a year of high labor costs and low production.

For the solution of marketing problems, the organization of producers and the adoption and maintenance of standard grades are recommended, as well as the development of merchandising methods which include advertising. Recommendations are made in this bulletin with reference to methods which may be immediately adopted and expected to prove practical.

The appendix includes suggestive articles of association for local associations of producers, as well as tabulated statistics of the production of maple sugar and sirup in Vermont and in other States, imports of maple sugar and sirup, farm value, and per capita consumption in the United States through a number of years.

Farm storage as a factor in the marketing of Kansas wheat, R. M. GREEN (*Kansas Sta. Bul.* 229 (1922), pp. 3-32, figs. 6).—In a survey of 748 farms scattered over 29 representative counties of Kansas, it was found that 5 per cent of the farmers had no storage space, and 20 per cent reported some shortage of space for the 1920 crop. Of 1,140,942 bu. of wheat reported, 17.2 per cent was sold direct from the threshing machine. Of this amount 81 per cent was hauled an average distance of 3.6 miles, 15.2 per cent an average of 8 miles, and 3.8 per cent an average of 16 miles. The average of farmers' estimates indicated 3.75 miles as the maximum distance wheat could be hauled economically direct from the machine where only ordinary equipment and labor forces are available. From 50 to 60 per cent of the wheat area of the State

is outside of this radius. This fact, together with the condition of limited local elevator storage space and a likely limited grain-car movement, indicates the economic necessity of farm storage in handling Kansas wheat.

The serious problem to be solved is said to be that of financing the holding of the commodity on the farm. Of 616 farmers finally reporting on the question, 57 per cent reported the necessity of borrowing money in order to hold their wheat. The average loan per farmer for this purpose only was \$1,170. The problem of the supply of funds is probably more pressing than that of interest rates.

Organization and management of cooperative live-stock shipping associations (*U. S. Dept. Agr., Farmers' Bul. 1292 (1923), pp. 11+28, figs. 3*).—This publication, prepared in the Live Stock, Meats, and Wool Division of the Bureau of Agricultural Economics, is a revision in the light of developments during the last five years of one previously noted (*E. S. R., 35, p. 168*).

Factors determining the price of potatoes in St. Paul and Minneapolis, H. WORKING (*Minnesota Sta. Tech. Bul. 10 (1922), pp. 3-41, figs. 7*).—An explanation is given of the operation of five fundamental factors which have been found to be important in determining the price of potatoes, namely, the production of potatoes in the entire United States, loss in storage, changes in the general price level, a steady and uniform annual increase in the demand for potatoes, and the failure of production to increase as rapidly as demand is increasing. Price statistics dating from September, 1899, to September, 1917, were obtained from dealers, later ones from the Bureau of Agricultural Economics, U. S. D. A. Certain checks used are described, and the monthly prices for September to May of the crop years 1899 to 1922 are tabulated as finally obtained.

The ordinary weighted arithmetic mean and the harmonic mean, or the average quantity sold for a dollar expressed in terms of price calculated by dividing 1 by the average price for each month, adding the figures thus obtained for each month, dividing by the number of months, and dividing 1 by the result, are given for each year.

A demand curve for potatoes in the United States is worked out, showing the amount of potatoes (adjusted) which will be taken at each of the various prices (also adjusted) within the range of the curve. By the term "amount of potatoes taken" is to be understood not only the amount bought by consumers but that which will be kept by farmers for their own use and for feeding and those left in the ground in case the price obtainable does not pay the cost of harvesting. The amount shown also includes the average quantities lost from rotting in storage and in other ways.

Other factors found not to have influenced price to a measurable extent are the production in States adjacent to the market, imports and exports, and general business conditions.

Statistical study of the price of potatoes for the years 1902-3 to 1920-21 gives the following formulas for estimating the average price of average quality table potatoes on the wholesale market of Minneapolis and St. Paul for the season September 1 to May 31:

$$\text{Price per bushel} = \frac{L \times T}{2.83Y - 174} \text{ and price per hundredweight} = \frac{L \times T}{1.70Y - 105}$$

where L equals the price level, Y the average yield per acre for the United States as a whole, and T the values for the quantity for the years 1921-22 to 1924-25 as given in the author's table. These formulas take care of all of the factors except loss in storage, and suggestions are made for allowing for this.

An average error of 9.5 per cent between the calculated price and the actual price is shown in an illustrative curve presented. This is attributed to certain definite causes. Suggestions are made for calculating the average price for a month, correcting the estimate for quality of potatoes and for other markets, and estimating the price of seed potatoes. The formula is applied to estimating the price for 1921-22, and suggestions and cautions are given for farmers who might use this information as a basis for a regular selling policy or as an aid to speculating on price changes.

Farm prices and railway rates, J. H. PARMELEE (*Jour. Farm Econ.*, 4 (1922), No. 3, pp. 144-149).—It is pointed out that freight rates on farm products have declined somewhat more than 11 per cent since 1920, thereby reducing the margin of 43 points between freight rates and farm prices. The attitude is taken that in general the adjustment of transportation rates should correspond to the adjustment in other costs of production. However, in case farm prices have been deflated because of other reasons than the high freight rate level, it might be argued that any further reductions in freight rates should be applied to other industries than agriculture and that a selective process of rate reduction tends to affect different railway companies differently. Furthermore, a general reduction in freight rates should benefit the farmer as a consumer even though it is at the expense of a greater reduction in rates on the products he sells. It is held to be useless for the farmer to expect as favorable a relation between the prices of what he sells and what he buys as existed before the war. The cost of transportation considered as one of the costs of production and distribution must be paid whether high or low.

The farmer and the railways, S. ANDERSON (*Jour. Farm Econ.*, 4 (1922), No. 3, pp. 137-143).—It is maintained here that the price which the farmer receives represents the terminal price less transportation and handling charges, and these from the farmer's point of view are therefore a part of his cost of production; hence the farmer is interested not only in a reasonable rate but in a reasonable relationship between the rates upon different commodities, with discrimination as between those of high and low value.

In an attempt to solve the problem of the disadvantage to the farmer in the present system of freight charges, the author suggests a consolidation of the railway systems of the country to permit the tonnage in territories having a greater traffic density to bear a larger proportion of the total cost of transportation as compared with the sections of the country having a less dense traffic; also a more discriminating application of rates in recognition of the general economic conditions and price levels existing in the country, price relations existing between different commodities, and the effect of freight rates upon the economic distribution of commodities, and a more flexible and simpler freight-rate structure.

The effect of freight rates on agricultural geography, B. H. HIBBARD (*Jour. Farm Econ.*, 4 (1922), No. 3, pp. 129-136).—A close connection between transportation facilities and freight rates and agricultural development is pointed out here. It is held that from the long-time point of view the buyer rather than seller of agricultural products pays the freight. Cheap transportation in the United States has up to the present time tended to make the country an economic unit, where territorial division of labor is carried to a high state of development and where agriculture has spread as far as cost of transportation will permit. The advantages of such a system are held to be likely to suffer a distinct setback from high rates.

A table is given contrasting the freight charges of 1921 and those of 1914 on a number of articles produced on the farm.

Social aspects of the food surplus in the United States, B. OSTROLENK (*Thesis, Univ. Penn. [Philadelphia], 1922, pp. [2]+92*).—In this thesis presented to the faculty of the graduate school of the University of Pennsylvania in partial fulfillment of the requirements for the degree of doctor of philosophy in sociology, agricultural production and food consumption over a period of years in the United States are examined, the author noting the general trend and the reaction of the production during the war period. It is concluded that the food surplus is decreasing as evidenced by the decreasing percentage of wheat exported and a decreased area, relative to population, that is being sown to wheat.

Consumption is said to be increasing while production is relatively fixed, and the implication is that, due to the tendency found that farm ownership relative to number of farms is decreasing while tenancy is increasing, secondary foods or those derived from live stock which demand increased skill, capital, and labor in their production will be produced in relatively smaller quantities.

A social study is made of the conditions surrounding the rural school and church and the farm home.

It is held that the next few decades will bring a shift either to increased yields or the importation of food, and the possibilities of improvement of this situation, involving a decreasing food surplus in the face of a growing urban population, through rural cooperation are noted.

Agriculture in Ohio and Switzerland Counties, W. V. KELL (*Purdue Agr. Ext. Bul. 112 (1922), pp. 24, figs. 17*).—A survey was made by the members of local committees on dairy, poultry, soils and crops, marketing, and boys' and girls' clubs, covering 400 representative farms of these two counties in southwestern Indiana. Detailed information was obtained and certain definite recommendations were made for the development of agriculture and the live-stock industry.

Agriculture, E. WELBOURNE (In *A Social and Industrial History of England. London: Collins' Clear-Type Press, 1920, pp. 68-80*).—This chapter from one of a series of continuation school manuals gives a history of the agricultural laborer and the tenant farmer in England, covering the inclosure movement, improvements in agriculture and live stock, the rise of the farm laborer class, and the disappearance of yeoman farmers.

Agriculture and population in Galloway, W. A. GAULD (*Scot. Geogr. Mag., 38 (1922), No. 4, pp. 232-242, figs. 3*).—These pages present a historical, geographical study of three natural units or physical divisions into which this region falls and of the distribution of existing types of agriculture.

A history of the evolution of the social conditions of the agricultural population of Belgium, M. HESPEL (*Ann. Gembloux, 28 (1922), Nos. 6, pp. 181-197; 7, pp. 235-247*).—This paper traces the steps traversed in the development of political and economic independence and prosperity by the agricultural classes in Belgium, touching briefly upon prehistoric and early Roman agriculture. The transition from collective to individual landholding systems under the Merovingian and Carolingian kings, the later growth of cities and gradual liberation of serfs during the feudal age and the development of renting systems and power of purchasing land on the part of the bourgeoisie which broke the exclusive monopoly of the nobility and the church in the land, new demands for working capital made by intensive systems of agriculture with an attendant extension of métayage and land renting, and the reflections on Belgian agriculture of the French Revolution are described in detail. Finally, the developments of the nineties with respect to improved scientific methods in agriculture are noted.

[The economic situation as regards agriculture and the food supply in Soviet Russia] (*Russ. Econ.*, 1 (1921), No. 2, pp. 380-392, 535-546).—These pages set forth the progress of the seizure of land and the distribution of State farms in Russia. The state of the food supply is reviewed statistically, and the scheme of organization of the commissariat of food supply is briefly outlined.

The resources and the needs of the French colonial dominions, A. MEGGLÉ (*Le Domaine Colonial de la France, Ses Ressources et Ses Besoins. Paris: Com. Natl. Conseillers Commerce Extérieur, 1922, pp. VIII+344, pls. 10*).—This is a compilation of information as to the history and geography, means of communication, resources, exports, and organization in general of the French colonies, protectorates, and territories under mandate.

An agricultural survey of the region of Fez, H. ROUPPERT (*Aperçu Agricole sur la Région de Fez. [Rabat]: Résidence Gén. Repub. Franç. au Maroc, Serv. Agr., 1921, pp. IV+154, pl. 1, figs. 15*).—The agricultural geography of this region and of its component administrative divisions is set forth, the principal crops and live stock and the extent to which they are grown being described.

Report on the working of the cooperative societies in the Punjab for the year ending July 31, 1919, M. L. DARLING (*Punjab Coop. Soc's. Rpt., 1919, pp. [47]*).—This report supplements information previously noted (*E. S. R.*, 41, p. 94).

Reports on the working of the cooperative societies in the Punjab for the years ending July 31, 1920 and 1921, H. CALVERT ET AL. (*Punjab Coop. Soc's. Rpts., 1920, pp. 33+5+LXXI; 1921, pp. 8+43+XCIII*).—These reports continue information noted above.

AGRICULTURAL EDUCATION.

The educational significance of the early Federal land ordinances, H. C. TAYLOR (*Columbia Univ. Teachers Col. Contrib. Ed., No. 118 (1922), pp. IV+138*).—The Ordinance of 1785 is said to be the foundation on which has been built the national land system of the United States. Education was a minor consideration, but that provision which reserved "the lot No. 16 of every township for the maintenance of public schools within the said township" set a precedent for dedicating public lands to public education. The history of this and other of the early ordinances dealing with the West is set forth in the early chapters of this study, together with an outline of the purpose and the accomplishments of the Ohio Company.

The so-called Ordinance of 1787 made specific provision for the encouragement of schools, and that enacted July 23, 1787, definitely granted every section 16 for the support of public schools in each township and also reserved two complete townships for the support of a university in the center of the first million and a half acres purchased by the Ohio Company.

The educational work of the early settlers in the Northwest is briefly described, and in this connection certain forces retarding it are pointed out.

Three plans for making land grants for common schools were tried by Congress. The first one has been mentioned; the second was that used in Illinois, by which every section 16 was granted to the State for the use of schools in each township; while by the third, first followed in Michigan, every section 16 was granted to the State for the use of schools, and the State was thus free to use the funds derived from these grants to encourage schools throughout the State. The last plan became the established policy of Congress.

It is held that there was little or no appreciation of the value of the land grants for education or interest in their management on the part of the public, and that in general the school lands and funds were poorly managed and frequently squandered. These grants were never adequate for the support of schools, and it is held that at times they have appeared to retard the growth of public education because they were used as an excuse for withholding other means of support. A most interesting educational tendency that has grown out of the early land grants for schools is the present-day policy of making national money grants out of the United States Treasury for education, as exemplified in the Smith-Hughes Act.

Sixth annual report to Congress of the Federal Board for Vocational Education, 1922 (*Fed. Bd. Vocat. Ed. Ann. Rpt.*, 6 (1922), pp. 31-43, 58-85, 103-238, figs. 3).—Portions of this annual report deal particularly with the vocational teaching of agriculture and home economics and the interpretation of statistics showing progress. In this field home economics part-time and evening schools are said to have experienced a notable development in recent years. A summary of progress in 1922 is given by States, noting agricultural and home economics education. A complete list of publications issued by the Federal Board for Vocational Education in 1922 is included.

Thirty-fifth annual report of the dean and director, 1922 (*N. Y. Agr. Col. (Cornell) Ann. Rpt.*, 35 (1922), pts. 1, pp. 73; 2, pp. 75-173).—The two parts of this annual report are printed separately.

I. *Administration, resident teaching, and research*, A. R. Mann.—This deals with the problems of administration, including the more important developments in the field of resident teaching and agricultural research at the New York State College of Agriculture and the Cornell Experiment Station. A method developed for the effective training of local leaders or teachers of home economics is briefly described.

The report of the station (pp. 47-69) is abstracted separately on page 694).

II. *The rise and the significance of agricultural extension*, M. C. Burritt.—This is a critical review of the origin, development, and present status of extension teaching of agriculture and home economics in New York, together with a statement of present methods and their results

State-wide activities of the college of agriculture (Nebraska Sta. Circ. 19 (1923), pp. [13], figs. 11).—The chart and nine State maps presented here set forth the organization of the Nebraska College of Agriculture; the registration at the university by counties, 1921-22; counties and numbers of individuals reached by extension activities, including boys' and girls' club work; the distribution of plans for farm buildings; and data as to animals treated for disease in 1922.

Statistics of cooperative extension work, 1922-23, E. MERRITT (*U. S. Dept. Agr., Dept. Circ. 253 (1923), pp. 19*).—This circular summarizes statistics relating to sources, amounts, and project allotment of funds used and the number and distribution of persons employed in the cooperative extension work in agriculture and home economics, compiled from the approved budget statements in which the State agricultural colleges have outlined their plan of work for 1922-23.

Agricultural experiment stations of Canada (*Canada Yearbook, 1921, pp. 301-310*).—These pages describe briefly the investigational work carried on by the Dominion Experimental Farms and stations and present reports on the colleges and schools of agriculture in Canada by Provinces.

Health education and the nutrition class, J. L. HUNT, B. J. JOHNSON, and E. M. LINCOLN (*New York: E. P. Dutton & Co., 1921, pp. XVIII+281, pls. 3*,

figs. 34).—This is a detailed study of the experiences of the Bureau of Educational Experiments with nutrition classes in a school in New York City. In addition to special provisions for physical diagnosis and care and correction where possible, the nutrition class is said to call for a daily régime of good eating habits, abundant food, frequent rest, and constant fresh air. The environmental conditions of the community in which this experiment was carried out are described, and the procedure and results obtained are discussed at length.

Elementary agriculture, H. J. WATERS (*Boston and London: Ginn & Co., 1923, pp. IX+349, pls. 6, figs. 255*).—The principal crops, including corn, wheat, hay, and pasture grasses, the legumes, cotton, tobacco, and others; the soil; farm animals; the garden; and the orchard are treated in this elementary textbook, and one chapter is given on marketing and farm organization. Simple practice exercises and study questions are included with each chapter.

Agriculture for southern schools, J. F. DUGGAR (*New York: Macmillan Co., 1923, rev. ed., pp. X+369, pl. 1, figs. 240*).—This is a revision of a text previously noted (*E. S. R.*, 20, p. 193).

Horticulture for schools, A. V. STUBENRAUCH, M. N. WOOD, and C. J. BOOTH (*New York: Macmillan Co., 1922, pp. XXIII+325, pls. 8, figs. 135*).—This is intended as a textbook of horticulture for pupils of high-school grade. The subject matter and exercises may be covered in one school year of three recitation periods and two double laboratory periods a week. The exercises given at the ends of the chapters are of three types: (1) Those that explain or illustrate the subject matter in the text, (2) those that familiarize the pupils with the best horticultural practices, and (3) project exercises that require the pupils to apply the facts, principles, and methods of procedure in detail to the production and sale of a particular horticultural crop.

A study of farm animals, C. S. PLUMB (*St. Paul, Minn.: Webb Pub. Co., 1922, pp. 551, figs. 261*).—This text discusses the feeding, care, and management of horses, cattle, sheep, swine, and poultry, as well as other subjects, such as community breeding, wool production, boys' and girls' live-stock clubs, co-operative live-stock shipping, poultry culling, and live-stock judging.

Plays for the country theater, A. M. DRUMMOND (*N. Y. Agr. Col. (Cornell) Ext. Bul. 53 (1922), pp. 241-312, fig. 1*).—A compiled list of plays, pageants, and operettas, collections of plays, periodicals, and elementary manuals is given here, with comment. Some especially adapted to the country theater are recommended.

MISCELLANEOUS.

Annual report of the director for the fiscal year ending June 30, 1922, C. A. MCCUE ET AL. (*Delaware Sta. Bul. 133 (1922), pp. 36, figs. 7*).—This contains the organization list, a report of the director including a financial statement for the fiscal year ended June 30, 1922, and departmental reports. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Annual Report of Georgia Coastal Plain Experiment Station, 1920, S. H. STARR (*Georgia Coastal Plain Sta. Bul. 1 (1921), pp. 22, figs. 11*).—This contains the organization list and a report of the director on the history and work of the station during the year. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-fourth Annual Report of Massachusetts Station, 1921, S. B. HASKELL ET AL. (*Massachusetts Sta. Rpt. 1921, pts. 1-2, pp. [5]+79a+179, pls. 5, figs. 12*).—Part 1 of this report consists of the organization list, reports

of the director and heads of departments, and a financial statement for the fiscal year ended June 30, 1921. The experimental work recorded and not previously reported is for the most part abstracted elsewhere in this issue.

Part 2 consists of reprints of Bulletins 201-206 and Technical Bulletin 4, all of which have been previously noted.

New knowledge: One year's work [at the Missouri Station], July 1, 1921, to June 30, 1922, F. B. MUMFORD ET AL. (*Missouri Sta. Bul.* 197 (1922), pp. 95, figs. 17).—This contains the organization list, a report by the director on the work and publications of the station, and a financial statement for the Federal funds for the year ended June 30, 1922. The experimental work reported is for the most part abstracted elsewhere in this issue.

The agricultural experiment station, and progress in research, A. R. MANN (*New York Cornell Sta. Rpt.* 1922, pp. 47-69).—These pages constitute the thirty-fifth annual report of the station, including a summary of its work and publications, and a financial statement for the fiscal year ended June 30, 1922.

Thirty-fifth Annual Report of South Carolina Station, 1922, H. W. BARRE (*South Carolina Sta. Rpt.* 1922, pp. 72, figs. 23).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1922, and a report on the work and publications of the station during the year. The experimental features reported are for the most part abstracted elsewhere in this issue.

List of serials currently received in the Library of the U. S. Department of Agriculture (*U. S. Dept. Agr., Dept. Circ.* 187 (1922), pp. V+358).—This circular lists the 5,586 serial publications (exclusive of those of the U. S. Government and the State agricultural colleges and experiment stations) received by the Library. It consists of a list of 2,610 titles of periodicals, prepared by M. T. Olcott, and superseding Library Bulletin 75 (*E. S. R.*, 22, p. 595); a list of 2,976 titles of other serials, such as annual reports and series of bulletins, each number of which is a monograph, prepared by E. B. Hawks; a subject list of all periodicals; and a geographical list.

NOTES.

Alabama College and Station.—Two greenhouses have been completed for the department of agronomy, materially extending its facilities for pot work and similar purposes.

The department of agricultural engineering has worked out a plan whereby special training will be given in the veterans' rehabilitation work in handling farm implements for a two-year period. On the completion of this training, the students are to form a connection with hardware and implement dealers on a commission basis, receiving pay from the Government for six months so that their trade can be established. It is thought that this plan will result in developing a corps of capable demonstrators, salesmen, and repair experts throughout the State.

California University and Station.—Sabbatical leave of absence for the purpose of travel and study has been granted to S. B. Freeborn, assistant professor of entomology; W. Metcalf, associate professor of forestry; G. W. Hendry, assistant professor of agronomy; A. Smith, assistant professor of soil technology; and D. R. Hoagland, associate professor of plant nutrition. E. C. Voorhies, secretary of the college and assistant professor of animal husbandry, has been granted five months' leave for foreign travel.

Connecticut State Station.—S. T. Sealy, in charge of mosquito work, resigned April 1.

Purdue University and Station.—A large packing shed and storage cellar for fruit, considered to be among the most modern plants of its kind in the State, has been erected on the Moses Fell Annex farm, operated by the station at Bedford. With a normal crop of from 6,000 to 12,000 bu. of apples from the orchards, it has been found necessary to have a suitable building in which the fruit may be properly graded and packed, and when necessary, stored to await shipment. Fruit growers of the State have also expressed a desire for information on the best methods for handling their crop, and the building will serve as a demonstration, experiments in cool and cold storage being conducted. The building is 68 by 36 ft., the first floor being used as a packing shed. The basement contains three storage rooms with a ceiling 1 ft. thick and thoroughly insulated. Cooling is accomplished by movement of cool air at night, and a forced draft is provided when necessary by means of electric ventilator fans. An elevator has been installed for carrying fruit to and from the basement.

During the past four years the horticultural department has cooperated with the Indiana Cannery Association in the production of high class tomato seed. From selected plants the station has produced about 30 lbs. of seed each year, and this has been furnished to a representative of the association who has planted about 300 acres of tomatoes from which more than 3,000 lbs. of seed have been saved and distributed to cannerymen in the State the following season. This procedure has given very valuable returns in production and quality.

During its 1923 session, the legislature amended the county agent law in several particulars. The amended law permits counties to appropriate not to ex-

ceed \$2 500 for the work of county agents, \$1,000 being available for salaries, and the remainder for expenses, and permits the appointment of a stenographer with the approval of the county council. Reappointments of county agents, which have hitherto been made annually, may now be renewed on the basis of two years. Salary payments will be made direct to the agents through the university instead of through the county as heretofore.

The station, extension department, and school of agriculture are preparing a handbook of facts for farmers, county agents, and others. The plan is to bring together in brief form a large amount of essential data with reference to the farm and home operations so that these may be in readily available form. I. J. Mathews, a former county agent, has been engaged as editor for this book, which it is hoped to compile by May 15. The book is to be sold at cost.

Iowa College and Station.—In response to the strongly expressed desire for curtailment of expenditures, the estimates of the State Board of Education for the college were considerably reduced, in common with those of the other State educational institutions. None the less, the college will continue to receive its allotment of the previous biennium of \$250,000 per annum for new buildings, and also new appropriations amounting to \$494,288 per annum, making its revenues larger than ever before. The increase may be used for such purposes as the Board of Education may decide upon, but for the first year the larger portion will probably be devoted to buildings, and the second year to maintenance. A decision has been reached to erect first a home economics building and second a dairy manufacturers' building.

H. W. Stacey has been appointed extension professor of rural sociology.

Massachusetts College and Station.—Samuel T. Maynard, one of the pioneer horticultural educators in this country and widely known as a writer and expert on horticulture and landscape gardening, died at Northboro, March 31, at the age of 78 years. Professor Maynard was a graduate of the college in its second class, that of 1872, and served continuously on the instruction staff until his retirement in 1902. In 1878 he became professor of botany and horticulture, and two years later professor of horticulture and horticulturist. During his long service he constructed and equipped the plant houses of the college, still considered by experts remarkable examples of pioneer greenhouse construction, and was largely responsible for the early planting and development of the college grounds, the orchards, and the vineyards. The earliest experimental work in horticulture was likewise under his direction. He was the author of numerous early horticultural texts, including the *Practical Fruit Grower* (1886), *Landscape Gardening* (1899), *Successful Fruit Culture* (1902), and the *Small Country Home* (1907).

The retirement under the State law of W. R. Hart and Dr. Charles Wellington upon the attainment of their seventieth birthdays took place March 31 and May 4, respectively. Dr. Wellington had been professor of chemistry since 1885. Professor Hart is said to have been the first professor of agricultural education in this country, and had served as organizer and head of the department of agricultural education in the college for sixteen years. W. S. Welles has been appointed head of the department, and Harry N. Glick professor of agricultural education.

Willard K. French and Charles H. Gould, assistant professors of pomology, resigned April 1 and April 30, respectively. J. S. Bailey and Frederick E. Cole, jr., have received appointments in the department of pomology. William L. Doran has been appointed assistant research professor of botany at the Market Garden field station at North Lexington, beginning April 16, filling the position recently vacated by W. S. Krout.

Michigan College and Station.—The college is asking for a total of \$2,300,000 for the ensuing biennium for new buildings, extension, research, and general improvements, this being in addition to its share under the mill tax for operating expenses. Among the items requested are \$400,000 for a new horticultural building, \$500,000 for a new chemical laboratory, two dormitories for women to cost \$125,000 each, \$100,000 for new barns and other farm buildings, like amounts to extend the college power plant and for various general improvements, \$350,000 per annum for extension work, and \$50,000 per annum for research.

Walter Bradford Barrows, professor of zoology and physiology and curator of the museum since 1894, died February 26 at the age of 68 years. He was a native of Massachusetts and a graduate of the Massachusetts Institute of Technology. His work had dealt especially with birds, and from 1886 to 1894 he served as first assistant ornithologist in the U. S. Department of Agriculture, also lecturing in economic ornithology at the Maryland Agricultural College. He was widely known as an authority on bird life, notably as regards migrating habits and economic aspects.

George Starr, a graduate of the college and for the past fifteen years connected with a commercial seed company, was appointed April 1 associate professor of horticulture in the station to have charge of plant breeding work and the production of improved strains and varieties of vegetables.

Minnesota University and Station.—The construction of a new dairy building has been authorized at a cost of \$220,000.

Charles Haralson, superintendent of the fruit farm, and Paul L. Miller, instructor in agricultural economics, resigned January 1. On the same date Wylie B. McNeal succeeded Mildred Weigley, resigned, as professor and chief of the division of home economics. Raymond E. Lubbehusen became assistant pathologist in veterinary medicine, Edward C. Johnson instructor in agricultural economics, and Frank M. Eaton assistant in the station.

Montana College and Station.—Because of insufficient State revenues, the appropriation bills passed by the legislature for the ensuing biennium were reduced from 5 to 20 per cent by the governor. The college receives \$323,156.75 per annum, the station \$98,921.25, the substations \$42,120, and the extension service \$111,647.16. Action was also taken by the legislature restricting expenditures from State funds to an amount sufficient to make up the allotted appropriations only after all receipts from other sources, including the Federal funds, had been exhausted. This action has the practical effect of reducing the station appropriations by \$25,000 per annum and the substation and grain laboratory funds by about \$20,000 per annum.

H. R. Sumner, assistant professor of agronomy in the college and assistant agronomist in the station, resigned January 1 to accept a position in the Kansas College, and has been succeeded by Irving J. Jensen, instructor in agronomy. Earl Norman Bressman of the New Mexico College and Station has also been appointed assistant professor of agronomy and assistant agronomist.

New Jersey College and Stations.—The appropriations granted to the stations by the legislature aggregate \$279,150. Of this amount \$80,000 is for salaries, wages, and maintenance; \$15,000 for publications; \$18,000 for mosquito extermination; \$6,000 for the oyster investigations; \$20,000 for poultry husbandry studies; \$8,500 for seed inspection; \$3,000 for experimental work with vegetables; \$1,000 for the inspection of insecticides; \$70,000 for extension work, an increase of \$5,000; \$5,000 for cranberry investigations; \$10,000 for egg-laying and breeding contests; \$12,000 for special experimental work with potatoes, sweet potatoes, and tomatoes; \$2,500 for other experimental work in

vegetable production; \$2,500 for experimental work with small fruits; \$2,000 for the inspection of legume inoculants; \$6,000 for poultry exhibitions and premiums; \$5,000 for sewage studies; \$3,500 for a study of root rot of peas; and \$3,000 for apicultural investigations. The College of Agriculture receives \$45,000 for its long course and \$25,000 for its short course work, as well as \$11,500 for the maintenance of various buildings. An allotment of \$7,000 is made for the purchase of a 23-acre tract adjoining the present college farm.

Ground was broken March 31 for the new dairy and animal husbandry building. This will be a 2-story and basement structure 105 by 83 ft. The first floor will contain suites of offices for the two departments, an auditorium for large classes or farmers' meetings, and rooms for dairy processing and manufacturing laboratories. The second floor will consist mainly of classrooms and laboratories for Babcock test work, dairy bacteriology, and dairy chemistry. A feeds laboratory will be located in the attic, and the basement will contain a meat cutting laboratory and meat refrigeration equipment. Special attention will be given in the new building to facilities for market milk production and ice cream making. An appropriation of \$150,000 is available for the construction of this building and \$50,000 for its equipment.

Unit courses of one week each have been given at the College of Agriculture this spring for the first time. In March a one-week course in tractor operation was offered, with two different groups of students and a total attendance of 31. The first unit of a course in beekeeping was also given during the same month, and this will be followed by a third unit of one week during the summer and a final unit in the late fall. It is planned to continue this type of instruction in the future.

H. J. Baker, director of extension at the Connecticut College, has been appointed director of extension, succeeding the late director, L. A. Clinton.

New Mexico College and Station.—J. C. Overpeck has been appointed professor of agronomy and station agronomist, succeeding E. N. Bressman February 1.

Ohio State University.—The new group of animal husbandry buildings has now been completed. The buildings consist of a horse barn, beef cattle barn, dairy barn, and sheep barn, forming the nucleus of a rectangular central group 120 ft. in width and 800 ft. in length. A judging pavilion will eventually complete the rectangle.

The horse barn is 40 ft. wide by 144 ft. long, with two wings each 20 by 60 ft., and has been designed essentially as a breeding barn. The sheep barn has a center 34 by 60 ft. flanked by wings 26 by 76 ft., and contains a judging ring. The beef cattle barn is 44 by 168 ft., with two sheds 20 by 100 ft. each and a silo, accommodates 40 animals in stanchions, and has numerous box stalls and pens. The dairy barn is somewhat narrower, 36 by 168 ft., with additions for young stock, a milk room, and two silos.

The barns are similar as to type of construction and are equipped with modern appliances. In planning the group, some experimental materials and forms of construction were incorporated to give opportunity for comparative studies of types and methods of equipment, such as stall fixtures, roof materials, and silos.

Utah Station.—A three-section greenhouse has just been completed to be used by the departments of horticulture, botany, entomology, field crops, and bacteriology.

The station mailing list is being revised. It is the plan hereafter to discontinue the sending of publications to a general list, postal card notices being used to announce new publications, these to be sent on request.

As a new project, the changes effected in the fats, carbohydrates, proteins, and phosphorus of wheat in storage are to be studied. The station in cooperation with the college practice farm is to run a feeding test with horses in order to determine the best proportion of hay and grain to feed farm horses doing light to medium work. Studies are also to be made of the feasibility of pasteurizing milk for cheese making.

Virginia College.—Dr. John M. McBryde, president emeritus since 1907, died at New Orleans March 20, at the age of 82 years.

Dr. McBryde was a native of South Carolina and educated at the universities of South Carolina and Virginia. Subsequently he received the LL. D. degree from Southwestern Presbyterian University in 1884 and the University of South Carolina in 1920, the Ph. D. degree from the University of Tennessee in 1887, and the D. Sc. degree from the Virginia Polytechnic Institute in 1907. During the Civil War he served as an officer in the Confederate Army and later in the Treasury Department of the Confederacy. After several years spent in farming in Virginia, he was appointed professor of botany and agriculture in the University of Tennessee in 1879, serving for three years, when he became professor of botany and president of South Carolina College, and from 1887 to 1891 president of the University of South Carolina and director of the South Carolina Station. In the latter year he became president of the Virginia Polytechnic Institute and served in this capacity until his retirement. He was an important factor in the upbuilding of the institute and among the few surviving pioneers in land-grant college education in the South.

Wisconsin University and Station.—Equipment has been installed in the series of agricultural greenhouses whereby meteorological conditions can be quite closely controlled. Four rooms, representing in general the various climatic conditions which obtain in Wisconsin during the growing season both as to temperature of the soil and air and humidity, were fitted up last season, and these have been in operation long enough to indicate that temperature and moisture variations can be sufficiently regulated for many purposes. Detailed studies in the relation of environment to plant diseases and plant growth can now be carried out without waiting for the occurrence of the seasons in nature. Work by the departments of agronomy, agricultural chemistry, horticulture, applied botany, and plant pathology, as well as cooperative studies with several bureaus of the U. S. Department of Agriculture, are already under way with this new equipment. At present the studies are mostly on seedling blight of wheat and corn, cold-resistant corn, onion smut, clover mildew, mosaic diseases, and tobacco problems.

A successful two weeks' course was held February 5–17 for the special instruction of Swiss cheese makers. There are several hundred of this class in the State, but because of their inability to speak English fluently difficulty has been experienced in reaching them. Another school has been requested for next year.

Laboratory methods were successfully substituted for the conventional type of annual meeting at a two-day session of the Wisconsin Veterinary Medical Association, which was recently held with about 150 members in attendance.

The annual Wisconsin Farmers' and Home Makers' Week, held at the college and station January 29 to February 2, took for its theme "merchandising, the farmer's way out." Agricultural economics, rural sociology, advertising, the grading of farm products, grain marketing, and other current problems were emphasized.

The bacteriological department has already received orders for the coming season for 2,200 packages of alfalfa cultures, 1,130 of cultures for clover, and nearly 400 of cultures for other legumes. The use of cultures for clover is

growing rapidly in spite of the fact that this legume is so well established in the State, and the rapid adoption of this method indicates how much more speedily scientific methods are now brought into use by farmers than in earlier years.

Construction work on the new buildings at the Ashland Substation is in progress. New manure pits are to be built and the present machine sheds completed. A wagon shed, hog house, and poultry house are to follow.

The first appointee from the university to a Scandinavian Foundation Traveling Fellowship was recently announced as J. A. Anderson, assistant in agricultural bacteriology and agricultural chemistry. This fellowship carries a stipend of \$1,000 and permits the recipient to study wherever he chooses. In this case the Stockholm Experiment Station has been selected for work on fermentation problems.

Wyoming University and Station.—J. A. Hill, wool specialist, who has been acting dean and director for several months, has been appointed dean of the College of Agriculture and director of the station.

Conference on Inheritance and Breeding of Cattle.—A conference to discuss plans for the furtherance of investigations on inheritance in cattle was held at the National Research Council in Washington, D. C., on April 27 and 28. The meeting was called under the joint auspices of the National Research Council and the U. S. Department of Agriculture. Reports were presented on the progress of work along this line at various institutions, and discussion was directed especially toward the outstanding problems and plans for future investigation.

It became apparent in the discussion and exchange of ideas that the relation of genetics to cattle breeding, while making possible a valuable scientific understanding of breeding problems and contributing practices of great economic importance, was falling short of its possibilities because of incomplete and inadequate records and a lack of system and standardization of methods.

In order to make fuller use of the information brought out by the discussions and to crystallize them into a more usable form, it seemed desirable and advisable to appoint smaller committees to study more completely certain seemingly more productive phases of the subject. The work of the committees is to be directed along the following lines: Formulation of a genetic program in cattle breeding; standardization of methods in general record keeping and management practices; and standardization of methods for correction for age and the like, and methods of taking measurements, photographs, and other similar data.

The following were present at the conference: F. R. Lillie of the University of Chicago, chairman of division of biology and agriculture, National Research Council; from the U. S. Department of Agriculture, E. D. Ball, Director of Scientific Work; J. R. Mohler, chief of the Bureau of Animal Industry; E. W. Sheets and S. Wright, Animal Husbandry Division; R. R. Graves, E. B. Meigs, and M. H. Forhman, Dairy Division; and G. Haines, States Relations Service; and from the State experiment stations, J. W. Gowen, Maine; W. W. Yapp, Illinois; C. H. Eckles, Minnesota; and L. J. Cole, Wisconsin.

ADDITIONAL COPIES

OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.

AT

10 CENTS PER COPY
SUBSCRIPTION PRICE, 75 CENTS PER YEAR

PURCHASER AGREES NOT TO RESELL OR DISTRIBUTE THIS
COPY FOR PROFIT.—PUB. RES. 57, APPROVED MAY 11, 1922

EXPERIMENT STATION RECORD.

VOL. 48.

JUNE, 1923.

No. 8.

About twelve years ago attention was directed in these columns to the beginning of activities in Great Britain under the so-called Development Act of 1909. This was a comprehensive piece of legislation designed primarily to develop the economic resources of the kingdom by providing funds for their gradual upbuilding over a period of years. It represented the first large-scale expenditure on the part of the British Government in aid of agricultural research, and its enactment attracted widespread interest. This interest has been well sustained during the years which have followed, and the marked progress which has been made has been the subject of general commendation.

The objects sought in the legislation were not restricted to the fostering of agriculture alone. They included the "promoting of scientific research, instruction, and experiments in the science, methods, and practice of agriculture (including the provision of farm institutes), the organization of cooperation, instruction in marketing produce, and the extension of the provision of small holdings, and the adoption of any other measures which appear calculated to develop agriculture and rural industries." Similar provision was also made for forestry through experiments, the teaching of methods, and the actual purchase and planting of land, and also for the reclamation and drainage of land, the general improvement of rural transportation, the construction of harbors and inland navigation, the development and improvement of fisheries, and for "any other purpose calculated to promote the economic development of the United Kingdom."

The administration of the act was entrusted largely to a board of five development commissioners appointed for terms of ten years each. To this board, subsequently enlarged to eight members, was given authority to approve either grants or loans for the purposes specified. No operations were to be conducted by the board itself, but the funds were to be expended by some Government department, such as the Ministry of Agriculture and Fisheries, or the Board of Education, an educational or other public institution, or an association of persons not trading for profit.

Under the original plan, an appropriation of £500,000 was to be made annually for a term of five years, beginning with April 1, 1910. Subsequently the payments were considerably advanced, and a supplementary grant of £400,000 was made in 1911-12, so that by 1913 an aggregate of £2,900,000 had been received. The fund was constituted as a revolving fund, available until expended, and by 1920 had been further increased by £641,000 from returns from interest on loans and other casual receipts, making a total income to that time of over £3,500,000. No further appropriations were voted by Parliament until 1919-20, when a grant of £1,000,000 was authorized. This amount was not expended, however, and when renewed in the year following, the governmental financial situation was such as to lead to a general restriction of all expenditures. In consequence the grant was never drawn upon, and the funds remained stationary until August 19, 1921, when an act was passed repealing the important war-time measure known as the Corn Production Act. This repealing legislation, while withdrawing much of the governmental aid from agriculture which had been given in the form of subsidies for grain production for several years, contained a clause appropriating £1,000,000 to the development fund for the fiscal year ended March 31, 1922. Of this amount £850,000 was made available for use in England and Wales, and the remaining £150,000 in Scotland. These sums are being utilized, making the total available amount since the inception of the legislation somewhat in excess of £4,500,000, or over \$20,000,000.

The proportion of the fund which has been expended in agricultural research and allied activities is not easily estimated. The report of the commissioners for 1921-22 indicated that the advances for that year aggregated about £172,000, which corresponds roughly with what in this country is supplied under the terms of the Hatch Act. It is said to constitute about 85 per cent of the total expenditure in the United Kingdom from all sources for agricultural research, and is more than ten times what was available fifteen years ago.

The system followed in the legislation of large lump fund revolving appropriations for apportionment over a period of years has a special interest in our own country because of the strong tendency of late in both Federal and State legislatures toward the policy of considerably itemized allotments, granted for a single year, and often with the requirement that incidental receipts must be deposited in the general treasury. The closest parallel to the British system in this country is in several of the large private endowments from which funds for research are allotted to institutions and individuals. Some advantages of the policy in the fostering of research are easily

demonstrated, and it is of interest to note that the experience with the development fund thus far appears to have been quite satisfactory.

In view of the large responsibility vested by the act in the development commissioners, it is not surprising to find that considerable time was taken by them for the formulation of policies. It was soon decided, however, that grants rather than loans should be made for research, and that the institutions receiving them should, as a rule, be required to supply the buildings and equipment, or in case grants were made for these purposes from the fund, that they should be duplicated from other sources. One result of this policy has been the raising of upwards of £100,000 from private sources, and in addition as the commissioners state, "a degree of sustained cooperation and interest in the work has been enlisted which would hardly have been forthcoming had the State alone provided the funds required."

In 1911 the commissioners outlined a plan for agricultural research with four main features. The first of these was the establishment of about fifteen research institutes, most of these to be devoted to a specific division of agricultural science and with an aggregate allotment of £30,000 per annum for maintenance. The second feature was the provision of technical advice for farmers in England and Wales at a cost of £12,000 by a corps of workers attached to certain teaching institutions. Thirdly, an allotment of £3,000 was contemplated for assisting scientific investigations not connected with a research institute. The final project was a system of scholarships for training scientific workers.

With some modifications, all of these plans were carried into execution. The advisory work was organized immediately by dividing England and Wales into twelve areas, each served by a college or university department of agriculture. The existing agricultural faculties of these institutions constituted a nucleus for advisory purposes, and from one to three special officers were appointed in charge of the extension work. Considerable difficulty was experienced in finding suitably trained candidates, the older well-qualified men seeming to prefer research or collegiate teaching, and at the outbreak of the war about one-third of the twenty-four positions were vacant. Subsequent appointments increased the personnel considerably, and a permanent increase of eight workers has recently been authorized.

The provision for small grants for specific researches proved popular, averaging about fifty applicants annually before the war. The funds available for this purpose were ultimately enlarged to £5,000 per annum. In 1922 grants were made to investigators at nine institutions. The subjects included a large range of inquiry, among

them being the fertilizing effects of carbon dioxide, insect fauna of soil, silver-leaf disease, green manuring, and a statistical examination of milk records.

The training of prospective investigators was instituted in 1911, a total of 36 scholarships being awarded in the ensuing three years. At the beginning of the war, no fewer than 9 of this number were in Germany, and 22 are known to have served in the British Army. In 1920 of the 30 then living, 17 or practically half of the original number were employed at research institutes, 4 by departments of agriculture, 6 in teaching, and 2 in scientific work abroad. About 160 papers had already been contributed by this group to scientific and technical journals, and the venture was considered as fully justifying the expectations of its originators. For the fiscal year of 1922, the allotment for research scholarships and traveling research scholarships was £2,000.

For the readers of the *Record* the most interesting feature is doubtless the chain of research institutes. In 1922 grants aggregating £78,000 were provided for work at 14 institutions in England and Wales, and about £10,000 for the Rowett Research Institute in Scotland. In addition smaller sums were granted for various miscellaneous projects elsewhere.

For some years before the passage of the Development Act the Board of Agriculture and Fisheries had been making plans for the systematic development of research, and the establishment of the institutes was among the first projects to receive approval. By 1914 the well-known work at Rothamsted had been largely extended, and new institutes were at work on plant physiology at the Imperial College of Science and Technology, plant breeding and animal nutrition at Cambridge University, dairying at Reading, helminthology at Birmingham, entomology at Manchester, agricultural economics at Oxford, animal pathology at the Royal Veterinary College and the board's own veterinary laboratory, and fruit growing at Bristol, while buildings were being provided for plant pathology at Kew and market garden and greenhouse problems at Cheshunt.

During the war efforts were made to carry on the essential work with such members of the staff as were available, but the majority of the male employees were engaged in special agricultural investigations with reference to increased food production. Thus, at Rothamsted the difficulties arising from a shortage of manure were studied, and monthly notes prepared for farmers. The Animal Nutrition Institute performed a similar service as regards feedstuffs. The Bristol institute worked out some very valuable methods of preserving fruits, and in 1918 prepared for the Food Production De-

partment about 250,000 lbs. of a new preserve in which the sugar necessary was obtained from the juice of cider apples.

Another interesting development of the war was the holding of weekly meetings of representatives of the institutes to discuss the needs of the current situation. These meetings proved so useful in stimulating experimental work that the Ministry of Agriculture and Fisheries subsequently organized an advisory council in agricultural research, at which the directors of the institutes and others meet periodically.

The substantial assistance rendered by the fund to institutions already in existence is well illustrated in the case of Rothamsted. When the first grant was made, the scientific staff at this institute consisted of a director and four other trained workers. The available land was practically all under permanent experiments, with little margin for new investigations. The laboratories were old and in need of renovation, and there were no farm buildings, implements, or live stock. By 1920 the farm had been enlarged from 60 to nearly 300 acres, and new buildings and equipment provided. The laboratories had been replaced by modern structures, and what is said to be one of the best agricultural libraries in the world had been secured. The scientific staff had been increased to 28 university graduates, and the total force numbered about 70 workers. Not the least important result had been the stimulation of private gifts to the institution, these totaling some £16,000. The classic activities of Rothamsted with regard to soil fertility have been continued and enlarged, and important new work has been added in plant pathology through the transfer of certain activities begun at Manchester, Birmingham, and Kew. One section of this work also deals with entomology, and a corps of 10 workers has been engaged in a survey of the microorganisms of the soil.

Another field in which substantial results have been obtained is that of animal nutrition. In England this work has been conducted mainly at the Animal Nutrition Institute at Cambridge University, while in Scotland the Rowett Research Institute has been developed in connection with Aberdeen University and the North of Scotland College of Agriculture. At Cambridge problems relating to meat production, the chemical investigation of feeding stuffs, and the physiology of reproduction have been given special attention, and a new type of calorimeter has been devised large enough to hold a sheep, pig, calf, or even a small steer or pony, though costing less than £500. At the Rowett Institute an elaborate plant has been constructed, aided materially by a gift of £10,000 and 41 acres of land by Mr. John O. Rowett. A large 2-story laboratory building, a set of experimental farm buildings, and other facilities for conducting

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

New microphotographs of the more common starches, C. B. FAIL (*Chem. Age* [New York], 31 (1923), No. 1, pp. 37-39, figs. 11).—Microphotographs are given of the following starches: Wheat, tapioca, buckwheat, potato, rice, navy bean, oats, rye, barley, corn, and soy bean. The photographs were taken with an ordinary achromatic microscope, using the high-power lens and a focal length sufficient to give a final magnification of 290. The starches were first stained with a dilute aqueous solution of fuchsin.

The microphotograph of the soy-bean starch is of interest on account of the small percentage of starch in the soy bean and the difficulty in obtaining it sufficiently free from protein. A satisfactory sample was finally obtained by hulling the carefully sorted beans by hand, grinding them in an agate mortar to pass a No. 17 silk sieve, and extracting the meal successively with carbon tetrachlorid, distilled water, 10 per cent NaCl solution, 0.2 HCl solution, and finally with 50, 70, and 90 per cent alcohol.

The guava, A. AZADIAN (*Ann. Falsif.*, 15 (1922), No. 169, pp. 405-408).—Data are given on the composition of the entire fruit, the seed, and the leaves of the guava (*Psidium guava*). The composition of the seeds is given as follows: Moisture 10.3, nitrogen 2.44, albuminoids 15.25, total ash 3, ash soluble in hydrochloric acid 2.69, ash insoluble in hydrochloric acid 0.31, alkalinity of the ash as K₂O 0.40, tannin 1.38, glucose 0.1, fat 14.3, cellulose 42.4, and starch 13.25 per cent. The oil extracted from the seeds by a mixture of chloroform ether and petroleum ether had the following average composition: Specific gravity at 15/15° C. 0.9124, index of refraction (Zeiss) 57.4, iodine number 131.1, saponification number 197.1, volatile soluble acids 0.26 per cent, volatile insoluble acids 0.25, and essential oil 0.27 per cent.

A comparison between the chemical and physiological characteristics of pepsin and rennin, F. FENGER (*Jour. Amer. Chem. Soc.*, 45 (1923), No. 1, pp. 249-255).—A brief report is given of an investigation covering a period of several years as to the chemical and physical properties of pepsin and rennin.

The materials first examined included the glandular layer of the fundus portion of hog stomachs and the mucous lining of the fourth stomach of young calves, these representing the foundation materials for pepsin and rennin, respectively. The examination included determinations in the material dried at 35 or 40° C. of petroleum ether-soluble material, moisture, ash, total phosphoric acid, total nitrogen, and total chlorid, and for proteolytic milk curdling and hemostatic activity. Determinations of inorganic chlorin were made on the ash.

The composition of the desiccated materials was quite similar, except that the hog stomachs were higher in both organic and inorganic chlorin. Both possessed considerable hemostatic properties, the hog lining clotting 1,000 times its own weight of oxalated blood in 55 seconds and the calf lining in 80 seconds. The proteolytic power of the dry hog stomach lining varied from 1:750 and

1:2,500, while that of calves was 1:350. The curdling power for milk was very slight for the former and marked for the latter, increasing with the acidity from 1:200 to 1:5,000.

Purified pepsin preparations were made from the minced, fresh lining of hog stomachs by digestion with acidulated water in suitable proportions. Rennin was prepared from calves' stomachs, first, by a salting out process, and later by a process depending upon the observation that rennin is precipitated from acid solution on careful neutralization just before neutrality to litmus is reached, and that the inactive colloidal precipitate thus obtained is rendered soluble and active by the addition of dilute acid. Analyses and tests of the purified materials are reported.

The purest pepsin prepared in the present study had a proteolytic power of 1:25,000. In the purified rennin no specific relation seemed to exist between the milk curdling and proteolytic activity. Slightly acidulated solutions of both enzymes gave the biuret and other protein reactions. On boiling, the pepsin solution became turbid and heavy flocculent precipitates separated, while the highly active rennins remained clear. It is concluded that both pepsin and rennin are proteins, the former being colloidal in nature and the latter a decomposition product of protein of the acid albumin type.

An internally heated laboratory vacuum pan, J. F. BREWSTER (*Indus. and Engin. Chem.*, 15 (1923), No. 2, p. 139, fig. 1).--The apparatus described may be made from two 6-in. diameter bell jars with ground flange and wide mouth. One is inverted to serve as the heating pan, while the other, fastened to the first with a rubber gasket, is fitted with a stopper containing a thermometer and a bent glass tube leading to the condenser. The mouth of the bell jar serving as the heating pan is fitted with a rubber stopper through which pass the feed and draw-off tubes of glass and the leads of the flat-wound heating coil of $\frac{1}{2}$ -in. copper tubing. The pan coil may be connected by brass unions or rubber tubing to the coil of a Fletcher instantaneous water heater or to a helix of copper tubing heated by a Bunsen flame. The condenser may be of the Soxhlet ball type or of block tin or copper tubing with water jacket.

A simple check valve, J. F. BREWSTER (*Indus. and Engin. Chem.*, 15 (1923) No. 1, p. 32, fig. 1).--A simple check valve has been devised at the Louisiana Sugar Experiment Station for use with the water vacuum pump to prevent flooding in case of a variation in water pressure.

The valve is made by cutting a flap in the small end of a rubber stopper. A hole is then bored through the rest of the stopper for a short piece of glass tubing to be connected with the system to be evacuated, and the stopper is fitted into a short section of glass tubing large enough to permit free play of the flap but small enough to hold the stopper securely. The other end of the glass tube is fitted with a one-hole rubber stopper provided with a small glass tube by means of which connection is made with the suction pump.

Electrometric acidimetry and alkalimetry without the use of hydrogen, P. A. VAN DER MEULEN and F. WILCOXON (*Indus. and Engin. Chem.*, 15 (1923), No. 1, pp. 62, 63, figs. 3).--As a substitute for the hydrogen electrode in electrometric titration, the authors have obtained satisfactory results with a polished platinum wire. If this is immersed in a solution of acid in distilled water and connected through a salt bridge with a calomel half-cell of the saturated type, the rate of change of potential, as read on a potentiometer, on adding alkali increases until neutralization has been effected and then decreases, the point of maximum potential being at the neutralization point. It is said to be possible also to substitute for the calomel half-cell a second beaker containing a solution of alkali in which a similar platinum wire is dipped.

To determine simply the end point of a titration, the potentiometer is dispensed with and the titration conducted as follows: A concentration cell is made up consisting of two beakers, one for the solution to be titrated and the other for a solution of a desired H-ion concentration. These beakers are connected through a salt bridge, and platinum wires, connected through a tapping key to the galvanometer, are placed in each beaker. The unknown solution is added until the deflection of the galvanometer changes direction, this representing the end point of the titration.

Titration curves for some common acids and bases as determined by the hydrogen electrode. C. E. DAVIS, E. T. OAKES, and H. M. SALISBURY (*Indus. and Engin. Chem.*, 15 (1923), No. 2, pp. 182-185, figs. 14).—Electrometric titration curves, obtained by a carefully standardized method which is described in detail, are given for hydrochloric, sulphuric, and citric acids with sodium hydroxid, primary calcium phosphate with sodium hydroxid and with sodium carbonate, orthophosphoric acid with sodium hydroxid and with sodium carbonate, and sodium carbonate with hydrochloric acid.

The stability of an N/100 sodium oxalate solution. E. S. HOPKINS (*Indus. and Engin. Chem.*, 15 (1923), No. 2, p. 149).—To prevent deterioration of N/100 sodium oxalate solution on standing, the addition of 100 cc. of 1:4 sulphuric acid to 1 liter of the oxalate solution is recommended. In the author's experience this addition will prevent the deterioration of the oxalate solution for at least two months, even when the solution is stored in clear glass bottles and exposed to daylight.

Rapid determination of potash in acid-insoluble silicates. M. M. GREEN (*Indus. and Engin. Chem.*, 15 (1923), No. 2, p. 163).—The method described depends upon the assumption that all metals except potassium form alcohol-soluble perchlorates and consequently that in a solution of the silicate in perchloric and hydrofluoric acids the potassium alone is left in insoluble form on the addition of 97 per cent alcohol. After the first separation with alcohol it is necessary to wash the precipitate thoroughly with hot water and reprecipitate the potassium by further treatment with perchloric acid and alcohol. This is necessary on account of the fact that iron and aluminum are held in the first precipitate, but on treatment with hot water are left as insoluble basic salts on the filter paper. Analyses in triplicate of 8 samples of silicate by the new method are reported and compared with corresponding values obtained by the J. Lawrence Smith method. The method is said to be accurate within ± 0.2 per cent.

Notes on the determination of phosphorus. G. E. F. LUNDELL and J. I. HOFFMAN (*Indus. and Engin. Chem.*, 15 (1923), Nos. 1, pp. 44-47; 2, pp. 171-173).—This paper is concerned chiefly with methods for the determination of small amounts of phosphorus in iron steel, alloy steel, and phosphor bronze by its separation as potassium phosphomolybdate and subsequent determination by weight as magnesium pyrophosphate, or by titration with alkali.

The first part deals with general considerations concerning the causes of phosphorus loss prior to the precipitation of the phosphomolybdate, the preliminary separation of phosphorus as ammonium phosphomolybdate, and the final determination of phosphorus by both methods. In the second or experimental part are given data on the determination of phosphorus by the alkalimetric method, and the technique of two methods adopted at the U. S. Bureau of Standards for the determination of potassium in metallurgical products, one an accurate method for use in such work as primary standardization and the other a more rapid routine method. Both require preliminary precipitation of potassium as phosphomolybdate. For standardization analyses the gravimetric method is used and for the other the alkalimetric.

Contamination of water samples with material dissolved from glass containers, W. D. COLLINS and H. B. RIFFENBURG (*Indus. and Engin. Chem.*, 15 (1923), No. 1, pp. 48, 49, fig. 3).—The possibility of the contamination of water samples collected for analysis in bottles of different kinds through the dissolving of material in the glass by the water was studied by analyses of soluble material in tap water and distilled water kept in different glass bottles for varying lengths of time.

The results of these analyses showed that the principal changes due to standing in contact with poor glass are an increase in the silica and sodium and the change of the alkalinity from bicarbonate to carbonate and hydroxid, with an increase in total alkalinity corresponding to the sodium. Samples of water in resistant bottles will not dissolve enough glass in a month to cause any detectable change in these values, while in nonresistant bottles changes may sometimes be noted after 24 hours.

The determination of the volume of bread, ARPIN and M. T. PECAUD (*Ann. Falsif.*, 15 (1922), No. 169, pp. 394-398).—The method employed by the authors for determining the volume of bread in comparative flour studies consists in first filling in any cracks or crevices in the bread with modeling clay, then dipping the loaf for an instant in a solution of rubber in benzene, and finally giving it a protective coating by spraying with varnish of cellulose acetate dissolved in amyl acetate. The loaf is then suspended, by means of an iron rod placed in the end, in a large dish of water provided with an outlet leading into a graduated cylinder. To the measured overflow of water is added the difference in weight of the loaf before and after immersion, this representing the amount of water absorbed by the bread. This method is thought to be more accurate than the customary measurement of volume by immersing the loaf in a receptacle filled with small seeds and measuring the overflow of seeds.

A new test for acrolein and its bearing on rancidity in fats, W. C. POWICK (*Indus. and Engin. Chem.*, 15 (1923), No. 1, p. 66).—The test, which is reported from the Bureau of Animal Industry, U. S. D. A., is described as follows:

"To 1 or 2 drops of dilute acrolein solution in a test tube 1 drop of an approximately 3 per cent solution of hydrogen peroxid is added. After about 1 minute, 5 cc. of concentrated hydrochloric acid (c. p., specific gravity 1.19) is added, and the test tube shaken. Finally, 5 cc. of a 1 per cent ethereal solution of phloroglucin is added, and the whole shaken. A deep red color is immediately imparted to the hydrochloric acid phase, which, on spectroscopic examination, shows a well defined, fairly narrow absorption band in the yellow-green region. In the absence of hydrogen peroxid the red color is not obtained, while when an excess of acrolein is used the condensation product separates as a purple precipitate."

It is noted that the test as described differs from the Kreis test for rancidity in fats chiefly in the use of hydrogen peroxid and the spectroscopic examination, and that the color yielded by rancid fats in the Kreis test is spectroscopically identical with that obtained with acrolein in the present method and probably represents the same substance.

New qualitative tests for rape and tung oils, A. W. THOMAS and C.-L. YU (*Jour. Amer. Chem. Soc.*, 45 (1923), No. 1, pp. 129, 130).—The test described for rape seed oil depends upon the observation that upon decomposing the magnesium soap from rape seed oil and dissolving the solid acids in 90 per cent alcohol a small amount of an acid insoluble in this solvent at 20° C. is obtained. The test for tung oil depends upon the observation that the magnesium soap of

this oil is insoluble in 90 per cent alcohol even upon prolonged boiling under a reflux condenser. The technique of both tests is described in detail.

The determination of the mixture of arachidic and lignoceric acids in peanut oil by means of magnesium soaps, A. W. THOMAS and C.-L. YU (*Jour. Amer. Chem. Soc.*, 45 (1923), No. 1, pp. 113-128).—A new method for the quantitative determination of peanut oil, based on the separation of the magnesium soaps of saturated and unsaturated acids in 90 per cent alcohol, is described in detail, with applications to mixed oils. The method is considered to have the following advantages:

"The constant errors such as are involved in the solubilities of lead soaps in ether are reduced to a minimum, a direct and more rapid separation of saturated and unsaturated acids in peanut oil is accomplished without the use of a second solvent, higher percentage yields of arachidic-lignoceric acid mixture than those from the 'lead-salt ether' method are obtained, and common vegetable oils, including cold-drawn cottonseed oil, do not interfere with the quantitative estimation of peanut oil at either 20 or 25° C."

A rapid method for the determination of salt in oleomargarin and butter, F. F. FLANDERS (*Indus. and Engin. Chem.*, 15 (1923), No. 2, p. 181).—In the method described a 3-gm. sample is placed in a small, narrow copper funnel made from a 2-in. section of No. 22 gage sheet copper. This is supported on a tripod of No. 18 copper wire and weighed on a torsion balance sensitive to 10 mg. The funnel and tripod are then transferred to the neck of a 300-cc. Erlenmeyer flask, the top of the funnel, which projects above the mouth of the flask, is gently warmed with a small flame until the fat melts and runs down into the flask, and the funnel is then rinsed with 15 cc. of chloroform and finally with hot water from a wash bottle, not more than 50 cc. of water being used. The solution is finally titrated with $N/10$ silver nitrate after adding 5 or 6 drops of 10 per cent potassium dichromate solution. A blank is run on the chloroform, using 50 cc. of water and 5 drops of chromate indicator.

The detection of salt in stock feeds, H. E. GENSLER (*Indus. and Engin. Chem.*, 15 (1923), No. 2, p. 158).—The author states that crystals of common salt in stock feeds may be detected accurately and rapidly by the following simple test: To 2 cc. of a 5 per cent solution of silver nitrate in a test tube of 1-cm. internal diameter is carefully added an equal value of the feed, previously ground to pass a millimeter sieve. The tube is then slowly inclined, and as the liquid is absorbed white patches of silver chlorid appear wherever a crystal of salt is present.

Recent progress in the chemistry of sirups and molasses, F. W. ZERBAN (*Indus. and Engin. Chem.*, 15 (1923), No. 1, pp. 7-9).—The topics discussed in this survey of recent work on the chemistry of sirups and molasses are new sources of sirups, new methods of preparation or purification, nature and composition of sirups and molasses, analysis, and utilization. Most of the work reviewed has been previously noted from original sources.

Chemical progress in cane-sugar manufacture, G. L. SPENCER (*Indus. and Engin. Chem.*, 15 (1923), No. 1, pp. 10, 11).—The chief contribution of the chemist to sugar manufacture in recent years is considered to be along the lines of control from the material of equipment to products and by-products. The limited use of chemicals in the various processes of manufacture is attributed not to lack of suitable reagents, but to the small possible margin of profit in changing existing methods.

Sauerkraut and its production, E. LE FEVRE (*Canner*, 55 (1922), No. 2, pp. 27-30, figs. 8).—This is a general description of the processes involved in the manufacture, storage, and marketing of sauerkraut.

Effect of salts upon the acid hydrolysis of wood, E. C. SHERRARD and W. H. GAUGER (*Indus. and Engin. Chem.*, 15 (1923), No. 1, pp. 63, 64).—The object of this investigation at the U. S. Forest Products Laboratory, Madison, Wis., was to find, if possible, a catalyst which might increase the yield of alcohol formed by the acid hydrolysis of wood according to the methods described by Kressmann (E. S. R., 47, p. 113).—

About 70 experimental hydrolyses were made, in which a large number of inorganic salts and two of the naphthalene sulfonic acids were tried. White spruce sawdust was used as the foundation material in each case. After about 20 runs had been made with no increase in alcohol, the various changes in technique were introduced, such as a second digestion with the same amount of acid, changes in temperature and pressure, preliminary treatment of the cellulose to break down lignin, the addition of glucose, and the use of hydrochloric instead of sulphuric acid. None of these modifications had an appreciable effect upon the amount of alcohol obtained. When compared with the yield of alcohol by the original method, slightly higher yields were obtained with 0.5 per cent magnesium sulphate, 0.5 per cent cobalt nitrate, 0.5 per cent ferric sulphate, 1.25 per cent zinc sulphate, 1.25 per cent cobalt nitrate, 0.5 and 1.25 per cent hydrosulfonic acid, and 1.25 per cent mercuric chlorid, in order of increasing amounts. The highest yield was 23.85 gal. of alcohol per ton of dry wood as compared with 21.85 with no catalyst.

Production of acetone, alcohol, and acids from oat and peanut hulls, E. B. FRED, W. H. PETERSON, and J. A. ANDERSON (*Indus. and Engin. Chem.*, 15 (1923), No. 2, p. 126).—Oat hulls and peanut hulls, by-products in the manufacture of oatmeal and of peanut butter and oil, respectively, have been subjected to hydrolysis with sulphuric acid by the process previously described for corncobs (E. S. R., 45, p. 510), and the resulting sirups fermented with *Bacillus acetoethylicum* and *Lactobacillus pentoaceticus*, as reported in the above-noted and later papers (E. S. R., 46, p. 208).

The yield of reducing sugars, calculated as glucose, averaged 26.5 per cent for the oat hulls and 7.6 per cent for peanut hulls. The sugars from both materials were almost completely fermented by *B. acetoethylicum*, yielding about the same proportions of acetone, alcohol, and acids as in the case of corncobs. On the basis of 100 lbs. of oat hulls, about 3.9 lbs. of acetone, 7.2 lbs. of ethyl alcohol, and 1.4 lbs. of volatile acids were obtained. Corresponding figures for peanut hulls would be decidedly lower on account of the small percentage of reducing sugars obtained on hydrolysis. The fermentation with *L. pentoaceticus* was very slow, considerable quantities of sugar remaining unfermented even after 30 days.

Potash from kelp.—VII, The manufacture of potash salts, J. W. TURRENTINE, H. G. TANNER, and P. S. SHOAF (*Indus. and Engin. Chem.*, 15 (1923), No. 2, pp. 159–163, figs. 5).—This continuation of the series of papers on potash from kelp (E. S. R., 47, p. 718) deals with the methods and apparatus employed for manufacturing potassium chlorid from the concentrated brines obtained from kelp charcoal, and with the manufacturing costs of the process. It is considered that kelp brine is a peculiarly favorable material for the manufacture of a good grade of potassium chlorid.

METEOROLOGY.

Influence of the weather on the yield of crops, J. W. SMITH (*U. S. Mo. Weather Rev.*, 50 (1922), No. 11, pp. 567–572, figs. 4).—This article briefly reviews the progress which is being made in formulating the influence of the weather upon crop production, describing especially a method, based on a

weather index representing the sum of the effects of unfavorable weather during the growing season and upon data for yields, which has given encouraging results in an initial study of the influence of weather on oats and corn in Illinois and cotton in South Carolina.

The daily quantities in which summer precipitation is received, J. S. COLE (*U. S. Mo. Weather Rev.*, 50 (1922), No. 11, pp. 572-575, *figs. 2*).—This article is briefly summarized as follows:

"The daily precipitation during the five months from April to August, inclusive, for the 12-year period from 1908 to 1919, inclusive, was studied at eight stations in the Great Plains and at Washington, D. C., Nephi, Utah, and Moro, Oreg. During 153 days of these months Washington had measurable precipitation on 55.8 days, the Great Plains on 41.7 days, Nephi on 26.3 days, and Moro on 21.8 days. Within limits, the quantity of precipitation is not determined by the number of days on which it occurs. In the Great Plains 82 per cent of the days having measurable precipitation have 0.5 in. or less and 45 per cent have 0.1 in. or less. In quantities from 0.05 in. up to a critical point, which is approximately 0.3 in. at Moro and Nephi, from 0.7 in. to 1.1 in. in the Great Plains, and 1.2 in. at Washington, the frequency of a given precipitation is inversely proportional to its amount. Above the critical point the decrease in frequency is more rapid than increase in amount. The number of precipitations below 0.05 in. increases with decreasing quantity, but not in the same proportion."

Daylight illumination on horizontal, vertical, and sloping surfaces, H. H. KIMBALL and I. F. HAND (*U. S. Mo. Weather Rev.*, 50 (1922), No. 12, pp. 615-628, *figs. 28*).—This article summarizes measurements of sky brightness and daylight illumination made during the year ended April 6, 1922, the measurements being made during 10 months in a suburb of Washington comparatively free from city smoke and during the other 2 months, one in summer and one in winter, in the smoky atmosphere of Chicago. The principal results and conclusions are as follows:

"With a cloudy sky the illumination on a horizontal surface is considerably more than twice that on a vertical surface, due to the fact that the region of maximum brightness is in or near the zenith.

"With high sun, as at midday in summer, the illumination from a cloudy sky averages higher than the illumination from a clear sky, except on a vertical surface facing the sun. This is not the case with low sun.

"The maximum illumination from a clear sky on vertical surfaces is a little in excess of 1,400 foot-candles, and occurs on surfaces facing the sun from early June to early September, between the hours of 8.30 a. m. and 3.30 p. m.

"The minimum illumination from skylight is on a vertical surface facing away from the sun. At Chicago in the smoky Loop District the illumination from a cloudless sky on such a surface averages about two-thirds the illumination at Washington on a similar surface from a clear sky.

"The total (solar+sky) illumination generally increases on surfaces sloping toward the south until the angle of slope reaches 20°, except with low sun during the summer months. The maximum is about 11,000 foot-candles at noon in midsummer.

"At Washington the illumination from a clear sky on both horizontal and vertical surfaces varies between 150 and 60 per cent of the average values; from a cloudy sky, between 200 and 30 per cent; from a sky partly covered with white clouds, on a horizontal surface three to four times, and on a vertical surface two to three times that from a clear sky; with rain falling, about half that from a cloudy sky."

The weather of 1922, A. J. HENRY (*U. S. Mo. Weather Rev.*, 50 (1922), No. 12, pp. 647, 648, pls. 2).—The weather of the United States as a whole during 1922 is briefly characterized as "warm and moderately dry." The rainfall was heavier than during the preceding year, but its distribution was very uneven. A rainy spring and early summer were followed by a period of deficient rainfall in more or less restricted areas in the Atlantic Coast States, the Ohio Valley, and portions of the Plains States. This shortage of rain continued throughout November and became acute, especially in portions of the Middle Atlantic States. Deficient rainfall was also the rule in the Pacific Coast States, especially in Washington and Oregon. An unprecedented flood in the Mississippi River Drainage Basin, which culminated in June, is noted below. A flood also occurred in Texas rivers in April and May and in the lower Colorado River in southern California in May. "The tendency to above normal temperature which has prevailed on this continent for some time continued throughout the year, excepting only the area between the Rockies and the Pacific."

[**Average temperature of the United States during 1922**] (*U. S. Dept. Agr., Weather, Crops, and Markets*, 3 (1923), No. 6, p. 127).—A table is given which shows the average temperature for the year and the departures from normal at various Weather Bureau stations throughout the country.

"The annual means ranged from 1 to 3° above normal in all sections east of the Rocky Mountains, but west of the mountains they were slightly below normal in most districts. The first three months of the year were abnormally cold in the more western States, and February was especially cold in the Northwest, where the monthly means ranged from 9 to 15° below normal. March, April, May, and June were persistently warm from the Mississippi Valley eastward, although temperatures, as a rule, were only slightly above normal in the Gulf districts. Unusually warm weather for the season was experienced during March in the Central-Northern States and in May from the Ohio and middle Mississippi Valleys northward. June was uniformly warmer than the average, except at a few points in the Northwest. July was the only warm-season month with temperatures below normal in most sections of the country, although August was unseasonably cool in the middle and south Atlantic areas. September and October were warmer than normal throughout the country, except in a very few limited sections, principally in the South and far West. November was uniformly cool west of the Rocky Mountains, and the average December temperature was below normal in the more northern States from the Atlantic to the Pacific Oceans. Otherwise these months were warmer than the seasonal average, the plus departures from the normal being especially high from the lower Mississippi Valley northward in November and throughout the southern half of the country in December.

"While the monthly mean temperatures ran quite uniformly above normal throughout the year in most sections, they were not unusually high at any time, and no prolonged hot spells were experienced. No previous high records were broken in any sections of the country, and the maxima were unusually moderate east of the Mississippi River. Between the Mississippi and the Rocky Mountains some rather high temperatures were recorded, ranging up to 107° F. in Kansas and Oklahoma."

The spring floods of 1922 in the Mississippi Drainage Basin, H. C. FRANKENFIELD ET AL. (*U. S. Mo. Weather Rev. Sup.* 22 (1923), pp. V+29, pls. 14, figs. 3).—This report presents "in convenient and compact form data bearing upon the causes of the floods, their character, extent, duration, and effects, together with such other matters of scientific and general interest as may pertain to the subject."

It is stated that these floods were epochal in at least two particulars, (1) in their extremely general distribution and (2) in the unprecedentedly high stages reached in the lower Mississippi River. It is estimated that the total losses due to the floods amounted to over \$17,000,000, and that the value of property saved by the Weather Bureau warnings amounted to over \$8,000,000. The actual loss due to damage to crops is estimated at \$276,250.

Monthly Weather Review (*U. S. Mo. Weather Rev.*, 50 (1922), Nos. 11, pp. 567-613, pls. 13, figs. 13; 12, pp. 615-676, pls. 15, figs. 38).—In addition to detailed summaries of meteorological, climatological, and seismological data and weather conditions for November and December, 1922, and bibliographical information, reprints, reviews, abstracts, and minor notes, these numbers contain the following contributions:

No. 11.—Influence of the Weather on the Yield of Crops (illus.), by J. W. Smith (see p. 713); The Daily Quantities in Which Summer Precipitation is Received (illus.), by J. S. Cole (see p. —); Note on Atmospheric Humidity in the United States (illus.), by R. DeC. Ward; Cause of the Accelerated Sea Breeze over Corpus Christi, Tex., by J. P. McAuliffe; Does the Formation of Abnormally Heavy Ice in the Bering Sea Cause Famine in Northern Japan? A Review, by J. B. Kincer; Notes on Typhoons, with Charts of Normal and Aberrant Tracks (illus.), by S. S. Visser; The Changing Arctic, by G. N. Ifft; Birds Storm-swept over the North Atlantic Ocean, by W. E. Hurd; and Mossman on the Physical Condition of the South Atlantic during Summer, by H. H. Clayton.

No. 12.—Daylight Illumination on Horizontal, Vertical, and Sloping Surfaces (illus.), by H. H. Kimball and I. F. Hand (see p. —); Some Meteorological Aspects of the Ice Patrol Work in the North Atlantic, by E. H. Smith; Polar Ice-drift and Sun Spots, by G. N. Ifft; A Review of Geophysical Memoirs No. 19 (Hurricanes and Tropical Revolving Storms, by Mrs. E. V. Newnham, with an introduction on The Birth and Death of Cyclones, by N. Shaw), by A. J. Henry; Relation of Weather Conditions to Wireless Audibility (illus.), by M. P. Brunig; The Connection Between Pressure and Temperature in the Upper Layers of the Atmosphere, by W. H. Dines; Average Free-air Winds at Lansing, Mich. (illus.), by C. L. Ray; Relation of Crop Yields to Quantity of Irrigation Water in Southwestern Kansas, by J. B. Kincer, a review of Kansas Station Bulletin 228 (*E. S. R.*, 47, p. 629); and The Weather of 1922, by A. J. Henry (see p. 715).

Climatological data for the United States, by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data*, 9 (1922), Nos. 11, pp. [188], pls. 3, fig. 1; 12, pp. [193], pls. 4, fig. 1).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for November and December, 1922.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. OSTRANDER and G. E. LINDSKOG (*Massachusetts Sta. Met. Buls.* 409-410 (1923), pp. 4 each).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during January and February, 1923, are presented. The data are briefly discussed in general notes on the weather of each month.

SOILS—FERTILIZERS.

Soil survey of Kootenai County, Idaho, H. G. LEWIS and W. A. DENECKE, JR. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils*, 1919, pp. IV+45, pls. 4, figs. 2, map 1).—This survey, made in cooperation with the Idaho Experiment Station, deals with the soils of an area of 515,840 acres covering about

two-thirds of Kootenai County in northern Idaho. The area occurs mainly in the Rocky Mountain soil region, but includes some areas of the Columbia River lava flow and of the loessial soils of the northwestern intermountain soil region. The area includes low flat bottom lands, gently rolling to undulating outwash plains, rolling to hilly foothills, high, gently rolling plateaus, and rough mountainous areas. The larger part of the county is said to be well drained, but the valley of the Coeur d'Alene River is subject to overflow.

The soils are of residual, glacial, eolian, and alluvial origin. Including rough mountainous land, scab land, muck, and peat, rough stony land, rough broken land, and river wash, 26 soil types of 14 series are mapped, of which rough mountainous land and Helmer silt loam cover 33.5 and 12.6 per cent of the area, respectively.

Analyses showing the deposition of lead in the débris from the stamp mills in the valley of the Coeur d'Alene River are included.

Farming the heavy silt loams of central Wisconsin, F. L. MUSBACH (*Wisconsin Sta. Bul. 347 (1922), pp. 3-36, figs. 20*).—Practical information on the proper cultural treatment of the heavy silt loam soils of central Wisconsin is presented in this bulletin. It is stated that heavy silt loam is the most important soil type in that region, occupying an area of from 5,000 to 6,000 square miles. This soil is said to be close textured and to retain moisture to a marked extent, so that surface drainage is of primary importance. Plowing in narrow "lands" with dead furrows connected with good outlets is recommended. Plowing to a depth of 6 in. in the fall has been found most desirable except where corn is to be raised. Spring plowing has given the best yields of corn. Neither subsoiling, deep tilling, nor deep plowing has been found profitable for crops grown in a rotation. These soils are said to be acid and require about 2 tons of limestone per acre. In addition, on the basis of fertilizer tests reported, the growing of legume crops and the use of manure supplemented with phosphatic fertilizers are practices recommended for permanent fertility.

Additional instructions for laying out and constructing the Mangum terrace, P. BAIN, JR. (*Missouri Sta. Circ. 98, Sup. (1922), pp. 2*).—This sheet supplements Circular 98 of the station (*E. S. R., 44, p. 620*).

Variability of alkali soil, W. P. KELLEY (*Soil Sci., 14 (1922), No. 3, pp. 177-189, figs. 4*).—Studies conducted at the Citrus Experiment Station of the University of California on the chemical composition of a large number of soil samples obtained from a 7-acre tract of alkali soil are reported. The samples were taken to represent the first- and second-foot depths, and in a number of instances the third- and fourth-foot depths also. The tract was divided into nine plats 100 by 330 ft. in size, and soil samples were taken at intervals of 10 ft.

on a line drawn across the greatest length of each plat.

The data indicate that the amount of one or more of the soluble salts in samples taken from a very small area varied enormously. The distribution of chlorid and sulphate was especially variable. Samples taken only 2 ft. apart showed a difference of more than 600 per cent in chlorid and of more than 1,000 per cent in sulphate content. The concentration of the several neutral salts was much more variable than that of the alkali carbonates, although the distribution of the latter was far from being uniform.

These results are taken to indicate that the analysis of a single sample of soil drawn from one place within the area studied has very little value. It was found, for instance, that one or more samples from each of several of the experimental plats contained practically no alkali salts. Other samples contained high concentrations of one or more salts, and still others had a composition intermediate between these extremes. It is considered quite doubtful

whether a composite sample of an alkali soil can be relied upon unless it be composed of a large number of individual samples, each of which was taken from an area in which the variation lies within reasonable limits.

The potential acidity of soils, O. ARRHENIUS (*Soil Sci.*, 14 (1922), No. 3, pp. 223-232).—Studies conducted at the University of California are reported on the so-called potential acidity of certain soils, which is considered to be an important and nearly overlooked factor.

It was found that in some cases there was a good correlation between the type of titration curve and fertility. A strong buffer action was found to indicate a good soil, and a weak one a bad or easily changed soil, provided the reaction of the soil lies within certain limits. Humus manuring and cultivation are considered to be the two factors for increasing the buffer effect. The results are taken further to indicate that the titration of soils may be used for the determination of the lime requirement.

The soil solution, extracted by Lipman's direct-pressure method, compared with 1:5 water extracts, P. S. BURGESS (*Soil Sci.*, 14 (1922), No. 3, pp. 191-215, *figs. 4*).—In a contribution from the Rhode Island Experiment Station a description of a direct-pressure method for securing sufficient quantities of soil solution for analytical purposes is presented, together with a quantitative chemical study of such solutions and a comparison of these results with similar data from the same soils obtained by the 1:5 water extract method.

A somewhat detailed description is also given of the apparatus, which consists of properly constructed presses for holding the soils, while heavy testing machines supply the required pressures. The soils used were fine sandy loams coming from different parts of California.

Preliminary experiments showed that the pressures used had no measurable effect on soil solubility, and that there was no appreciable fining or abrasion of the soil particles due to the pressures applied. In experiments with eight soils, moistened to but 50 per cent of their total moisture-holding capacities, over 60 per cent of the water was extracted in five cases, over 52 per cent in two cases, and about 45 per cent in one case. Very little solution was secured from any of these soils with a pressure greater than 10,000 lbs. per square inch.

A comparison of the soil solutions obtained by the two methods from two points of view led to the conclusion that all of the water in soils is free to act as a true solvent.

The comparison also brought out that "where the 'unfree water' is subtracted, about twice as much calcium, magnesium, nitrate, and sulphate is removed in 1:5 water extracts as is found in the soil solutions. The potassium-ion determinations show the extracts to carry, on an average, 5 times as much as is dissolved in the soil solutions. In the case of phosphates, approximately 35 times as much is removed by the excess of solvent. Where we do not subtract 'unfree water,' but consider that all of the soil moisture is capable of uniformly dissolving soil materials, we find that the average amounts of calcium, magnesium, and nitrate dissolved and removed are practically equivalent by the two methods, while about 3.5 times as much potassium and 1.7 times as much sulphate are removed by the 1:5 extraction method. The phosphate ion is still dissolved in large quantities (over 30 times as much) by the excess of solvent."

A definite relationship was shown to exist between the conductivity measurements of soil solutions and of 1:5 water extracts of the same soils. These data were also in close agreement with the known productivity of the several soils examined. Brief mention is made of certain experiments wherein the soil-pressure method was found to be of questionable value for securing satisfactory quantities of a uniform soil solution with certain soils.

Microbiological analysis of soil as an index of soil fertility.—II, Methods of the study of numbers of microorganisms in the soil, S. A. WAKSMAN (*Soil Sci.*, 14 (1922), No. 4, pp. 283-298).—In a second contribution to the subject (E. S. R., 48, p. 119), studies conducted at the New Jersey Experiment Stations on methods for determining numbers of microorganisms in the soil are reported.

It was found that a medium of standard composition should be used containing no peptone, meat extract, soil extract, or similar material which would vary greatly in composition. In addition to the necessary minerals and carbohydrates the medium should contain a definite nitrogen source, like asparagin, purified casein, or powdered egg albumin. The final reaction of the medium should be about pH 6.2 to 6.8 with an optimum at pH 6.5. Sterile tap water should be used for making the dilution. The soil should be shaken uniformly for five minutes in preparing the first dilution.

The original dilution should be 1:20 or 1:10, high enough to give a ready distribution of the bacteria and low enough to allow a representative sample to be taken. The further dilutions should be uniform, preferably 1:10 or 1:100. The final dilution should be made in such a manner as to give from 40 to 200 colonies of microorganisms, excluding fungi, per plate. Where a count of soil fungi is wanted, special acid media should be used having a pH value of 4 (like raisin agar and special synthetic agar), which, due to their nature, do not allow any development of actinomycetes or bacteria, so that a low dilution ($\frac{1}{50}$ to $\frac{1}{100}$ of that used for bacteria) can be used. This combined with a short incubation period will allow a count of fungi involving a comparatively low probable error.

At least three to five samples, composite if possible, should be taken from each soil examined for each determination. At least six to ten plates should be used in plating out each sample. These last two points are important where it is desired to work out the variability of numbers of microorganisms and reduce these to a mathematical standard. The plates should be incubated at 25° C. for at least 7 days or at room temperature for at least 15 days, the first to be preferred due to uniform temperature. Plates badly overgrown with fungi, particularly in case of certain Mucorales, should be discarded from the counts.

The numbers should be computed on the basis of wet soil or soil dried to constant weight, in each case stating the moisture content and the moisture-holding capacity, or optimum moisture, of the particular soil. The most probable error of the counts should not be greater than 2 to 2.5 per cent for each soil, and not above 3 per cent for each soil sample.

The effect of reaction on the fixation of nitrogen by Azotobacter, H. W. JOHNSON and C. B. LIPMAN (*Calif. Univ. Pubs. Agr. Sci.*, 4 (1922), No. 12, pp. 397-405, figs. 3).—Studies are reported which were undertaken to determine the effect of various H-ion concentrations on the ability of *Azotobacter chroococcum* to fix nitrogen. A strain of *A. chroococcum* was used which was isolated from a California soil and which had previously been found to be very efficient in nitrogen fixation and to produce abundant pigment. The reactions of the nutritive solutions used were determined by the hydrogen electrode, and changes in the reaction during incubation especially were measured.

It was found that the reaction of the solutions having pH values below 8 changed very little. No growth occurred below pH 6, and between pH 6 and pH 8 there was little change because the solutions were highly buffered. Above pH 8 the reaction changed greatly, possibly due to incomplete reaction of the alkali at the time of titration, but more probably due to absorption of carbon dioxide by the strong alkali.

The amount of nitrogen fixed was not greatly affected by reactions between pH values of 6.2 and 8.8, although reactions around pH 7 and 8 seemed to be the most favorable. Slight changes outside of these values caused an abrupt decrease in fixation.

Nitrate accumulation under straw mulch. W. A. ALBRECHT (*Soil Sci.*, 14 (1922), No. 4, pp. 299-305, figs. 3).—Three years' studies at the Missouri Experiment Station to determine the effect of a straw mulch on nitrate production in a brown silt loam soil of glacial origin and of a fine friable structure to a depth of about 8 in. are reported. Four $\frac{1}{8}$ -acre plates were used. One plat was plowed in the spring and during the summer was fallowed and given a straw mulch of 8 tons per acre. Two other plats were plowed and fallowed, the surface of one being scraped and that of the other cultivated. The fourth plat was fallowed without plowing and the surface was scraped.

The data indicate that the straw mulch prevented the accumulation of nitrates in this soil. During the three years of study the nitrate accumulation under mulch was never greater than 27 lbs. per 2,000,000 lbs. of soil. Without the mulch this figure went over 200. Comparatively few of the minimum determinations of the unmulched plats went below even the maximum on the mulched plat.

The graphic data show that there was a close reciprocal relation of moisture to nitrates, indicating that moisture was an inhibiting factor and is the main cause directly or indirectly for the inhibition of nitrate accumulation. The mulch is considered to increase the moisture in the soil by increasing absorption through lessened run-off and prevention of evaporation.

Influence of kind of soil and fertilization on the contents of crops in nitrogen and ash constituents. J. G. MASCHHAUPT (*Dept. Landb., Nijv. en Handel [Netherlands], Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefsta., Nos. 25 (1921), pp. 115-129; 27 (1922), pp. 114-124*).—In a further contribution to the subject (*E. S. R.*, 41, p. 813), the results of studies conducted during 1918 to determine the influence of potassic and phosphatic fertilization on the composition of winter wheat on the experimental soils are presented. The fertilizer treatments consisted of nitrogen alone, complete fertilization, nitrogen and potash, and complete fertilization with a double application of potash.

The highest total weight of yield was obtained from the marsh soil and the lowest from the loam soil. The nitrogen content of the wheat from the former soil was high and of that from the latter low. Fertilization with potash and phosphoric acid apparently had little influence on the wheat crop. The results of ash analyses of other crops are also reported and discussed. These showed that clay soils rich in lime produced crops of beets, for instance, which contained less lime than beets grown upon old clay soils almost free from lime. Results with oats also are taken to indicate that the lime content of the crop is practically independent of the lime content of the soil.

A continuation of the above studies during 1919 revealed the influence of the soil on the composition of flax crops. The nitrogen content was highest on marsh soil, and in contrast to previous years the phosphoric acid content on this soil was also high with the exception of the flax crop. The influence of fertilization was in general not very marked. Potash fertilization showed the greatest influence on crop stalks on sand, moor, and marsh soils. The flax crop withdrew more potash from the soil than is ordinarily considered normal. The main difference between wheat and flax in their reactions toward the soil was that the wheat absorbed a much greater quantity of silica than the flax.

Fertilizers, rational and lucrative use, A. C. GIRARD (*Les Engrais, Emploi Raisonné et Lucratif*. Paris: Libr. Agr. Maison Rustique, [1922], pp. 163).—This book is a number of the Nouvelle Bibliothèque du Cultivateur series. The general subject of fertilizers is introduced by discussions of the soil and plant, with particular reference to the nutrient requirements of the latter. Succeeding chapters discuss calcareous amendments, barnyard manure, nitrogenous, potassic, and phosphatic fertilizers, and mixed fertilizers. A brief section deals with catalytic and radioactive fertilizers, bacterial cultures, and soil disinfection. Final chapters deal with the rational use of fertilizers, the general features of fertilizer research, especially in France, and fertilizer regulatory work.

Fertilizer experiments with different new nitrogenous fertilizers, W. VON KNIRIEM (*Mitt. Deut. Landw. Gesell.*, 37 (1922), No. 43, pp. 654, 655).—Experiments with potatoes and beets on loamy sand soil to compare ammonium sulphate, urea, and ammonium sulphate nitrate as sources of nitrogen are briefly described.

Urea gave the best results with potatoes, followed in order by ammonium sulphate and ammonium sulphate nitrate. The percentage of small potatoes increased as the application of nitrogen increased. The highest application of nitrogen produced the largest crops of both potatoes and beets. On the basis of these experiments the use of urea is recommended where the cost permits.

Effect of certain calcium compounds and other substances on the yield and calcium content of some crops, O. M. SLEDD (*Soil Sci.*, 14 (1922), No. 4, pp. 233-246).—In a contribution from the Kentucky Experiment Station, pot experiments in the greenhouse made on six soils representing four different types in the State, in an effort to determine whether there was a deficiency of nutrient calcium, are reported. Soy beans, sweet clover, alfalfa, and oats were grown in rotation, following applications of different calcium salts.

In some instances the addition of calcium compounds to these soils increased the yield of some crops both in grain and straw or hay or in the ash and calcium contents. A considerable variation in the percentages of ash and calcium of the same plant, both in grain and in straw or hay, was found when grown on different soils or even the same soil where different treatments were given.

Silica treatments appeared to exert a favorable influence on the yield of soy beans and oats on some soils. Appreciable gains were obtained by the use of magnesium silicate in many instances, especially in the yield of some grain. These are attributed in part at least to the beneficial influence of the magnesium, although there was some reduction of the soil acidity by this treatment. Where magnesium silicate was applied to the soil, the average calcium content of the hay or straw of all crops grown and of the grain of oats was lower than that by any other treatment.

The acidity of the soils was materially reduced by some treatments, but it is not believed that all of the increased yields could be attributed entirely to this fact. A comparison of the averages of calcium with no calcium treatments showed that the crops obtained by the former usually removed much larger quantities of calcium from the soil. This is thought to be due probably to the fact that, where no calcium treatment was given, the plants were in need of an adequate supply of available calcium for growth.

Calcined phosphatic limestone as a fertilizer, E. VAN ALSTINE (*Soil Sci.*, 14 (1922), No. 4, pp. 265-281, figs. 3).—Studies conducted at the New Jersey Experiment Stations on the fertilizing value of samples of phosphatic lime-

stones taken from several localities in southern Tennessee and subsequently calcined are reported.

It was found that burnt and hydrated phosphatic limestone is considerably inferior to acid phosphate as a fertilizer in either sand or soil cultures. The amount of hydrated lime supplied by using burnt phosphatic limestone in amounts corresponding to 400 lbs. of acid phosphate per acre was entirely ineffective in correcting the lime requirement of an acid soil.

Any advantage that burnt and hydrated phosphatic limestone may have had over phosphate rock was so slight as to be accounted for by the fact that its iron and aluminum contents are lower and are in less intimate contact with the tricalcium phosphate. Pulverized phosphatic limestone was as valuable for soil treatment as any of the phosphatic products obtained in the test from the burning of this limestone.

Silica and silicates in relation to plant growth and composition, C. J. SCHOLLENBERGER (*Soil Sci.*, 14 (1922), No. 5, pp. 347-362).—In a contribution from the Ohio Experiment Station, studies are reported which included two series of pot experiments and one field experiment on small plats, designed to determine the effect of blast furnace slag and other carriers of silica on the base content of soils and the assimilation of phosphorus by plants.

One series of pot experiments included thirty 20-in. cylinders with 16 treatments, and was designed to show the effect of silica applied in various forms to an acid silt loam soil with and without calcium carbonate, rock phosphate, or soluble calcium phosphate. Data from two crops of soy beans and one each of oats and buckwheat are presented. These showed that silica added as air-dry hydrated silica plus dialyzed silica, blast furnace slag, calcium silicate, and sodium silicate was assimilated, as shown by increased percentages of plant silica in the crops. The silica was generally increasingly available from the compounds in the order given. Buckwheat showed the smallest differences in silica content as the result of treatment and oats the greatest. Additions of calcium carbonate usually appeared to lessen the amounts of silica taken up by the plants.

Ground blast furnace slag was an effective source of bases and its silica was to some extent assimilated, but conclusive evidence that the silica thus added to the plant is of use in enabling the plant to utilize more phosphorus from rock phosphate was not obtained. Except for buckwheat, calcium silicate was also an effective source of silica. The silica from this source appeared to enable most of the crops to obtain more phosphorus when that element was added as rock phosphate.

Pots treated with various silica compounds and soluble phosphates furnished no data on which to base conclusions as to the action of silica in phosphorus assimilation. A majority of the pots to which additions of silica compounds with calcium carbonate were made showed increased yields and phosphorus content in the crop as compared with pots receiving calcium carbonate only, the soil being the sole source of phosphorus.

A second similar series of eight cylinders furnished a comparison of the effects of equal weights of slag, precipitated calcium silicate and carbonate with and without a complete fertilizer. Seven crops were grown on this series of pots, and, with the exception of one season, yields on the pots to which the silicates were applied were greater than yields from check pots or those receiving carbonate.

Benefit from calcium carbonate was unmistakable only after the second year, but became increasingly noticeable with time. Of the three crops from which samples were analyzed, only the soy beans showed any consistent relation between silica and phosphorus utilization. With this crop the plants were

higher in phosphorus on those pots where silicates were used instead of carbonates. The wheat crop indicated that the opposite was the case, but low yields accompanied the high phosphorus percentages.

A field test in which finely ground slag applied at the rate of 3 tons per acre was compared with half as much limestone, probably somewhat coarser, on wheat indicated that the slag caused a slightly larger yield of less well developed grain. This is thought to be due to a more abundant supply of available nitrogen on the plat to which the slag was applied. The slag caused a considerable increase in the silica content of the wheat plant, but the phosphorus content was decreased.

A note on oxidation of sulphur in Oregon soils, J. S. JOFFE and H. C. McLEAN (*Soil. Sci.*, 14 (1922), No. 3, pp. 217-221).—Studies conducted at the New Jersey Experiment Stations on the sulphur-oxidizing capacities of eight Oregon soils, known for their response to sulphur treatments with consequent increases in alfalfa yields, are reported.

It was found that soils having a low sulphur-oxidizing capacity should receive sulphur applications in advance of the growing season. The buffer action of these soils was measured by the changes in the H-ion concentration of the soil extract. Most of the soils investigated did not change materially in reaction after having oxidized most of the 250 lbs. of sulphur used. This is taken to indicate that elemental sulphur may be applied as a fertilizer to these soils without danger of injuring crop production due to the acidity of the sulphuric acid formed. Comparisons of inoculated and uninoculated sulphur showed that the former is more effective.

Influence of sulphur oxidation upon growth of soy beans and its effect on bacterial flora of soil, W. RUDOLFS (*Soil Sci.*, 14 (1922), No. 4, pp. 247-263 figs. 4).—Studies conducted at the New Jersey Experiment Stations to determine whether or not a slightly alkaline soil which produces chlorosis would be benefited by additions of sulphur are reported. The soil used was a Hanford fine sandy loam and was divided into two parts, one to be used for plant cultures and the other for bacterial studies.

Small amounts of inoculated sulphur had little or no influence upon the change of the H-ion concentration of soil which had received fertilizers for 30 years, but additions of larger quantities lowered the pH values. The influence of sulphur oxidation was greater in soil which had received no fertilizers for 33 years, and which was poorer in nitrogen and mineral plant nutrients than the first soil. The H-ion concentration increased nearly proportionally to the sulphur application. Soils receiving rock phosphate in addition to the sulphur usually had higher H-ion concentrations than the soils receiving sulphur alone.

Soy bean plants grown in soil treated with inoculated sulphur were stimulated by small additions of sulphur, but were injured by larger additions. Sulphur added with acid phosphate produced the best soy bean plants, while those of the series receiving sulphur and rock phosphate were the poorest. The root systems of these soy bean plants were stimulated by small quantities of sulphur, but depressed by larger amounts. Nodule formation seemed to be stimulated by small amounts of sulphur, but decreased numerically with the increase of the quantities of sulphur applied.

The phosphorus of Florida soft rock phosphate used in the experiments became available when a point in the H-ion concentration between pH values of from 3.1 to 2.8 was reached. The acidity produced by the oxidation of sulphur in these soils was not sufficient to render appreciable amounts of phosphorus more available, although the acidity produced was harmful to the soy

bean plants. It was found in sand cultures that if sufficient acidity is produced to make the phosphorus available the plants are killed.

Doubt is expressed whether greater beneficial effects can be expected from phosphate and inoculated sulphur mixtures which have not been composted long enough previous to the application so that the sulphates and free acid formed have reacted with the phosphorus of the rock phosphate than from rock phosphate alone, unless the soil is in need of sulphur.

The H-ion concentration became greater in the uncropped soil with sulphur additions until a certain point was reached; from then on the movement was back toward the neutral point. The biological flora, expressed in numbers counted on agar plates from soil infusions, were slightly stimulated by small sulphur applications, but considerably depressed with larger amounts. The formation of sulphates was influenced by the water content of the soil.

Sulphur oxidation in inoculated and uninoculated greensand mixtures and its relation to the availability of potassium, W. RUDOLFS (*Soil Sci.*, 14 (1922), No. 5, pp. 307-319, figs. 2).—Experiments at the New Jersey Experiment Stations are reported, which were conducted primarily for the purpose of determining the effect of uninoculated sulphur as compared with inoculated sulphur upon the availability of potassium. In the second place, the object was to study the possibility of decreasing the large quantities of soil used in earlier experiments, so as to make composting of greensand with sulphur more practical for the farmer or manufacturer, and in the third place, to determine the effect of ammonium sulphate upon the rapidity with which the potassium in greensand becomes available when no soil is used in the mixtures.

The experiments consisted of composting greensand with sulphur and soil in varying proportions and with additions of ammonium sulphate. Commercial sulphur and Penn loam soil were used. The greensand contained a fairly high percentage of potassium and but a trace of calcium. Half of the mixtures were inoculated with infusions known to contain sulphur-oxidizing organisms, and no sulphur-oxidizing organisms were added to the other half.

It was found that small amounts of potassium are liberated in composts consisting of greensand and sulphur. No great differences occurred between inoculated and uninoculated sulphur-greensand mixtures, because there was contamination of the uninoculated mixtures. The potassium of the greensand was made available at a certain H-ion concentration lying between the pH values 2.7 and 2.3. There was a definite relation between the H-ion concentration and sulphate formation and the water-soluble potassium.

Soy bean plants grown in quartz sand and with Shive's nutrient solution in which composted greensand was substituted for the potassium of the cultural solution were able to make as great a dry weight of tops as in similar cultures in which the potassium was supplied in the form of potassium phosphate. Soy bean plants receiving composted greensand as a source of potassium matured earlier and yielded more seeds than the plants grown in Shive's cultural solution.

Radioactivity in agriculture, G. M. Tosi (*Italia Agr.*, 59 (1922), No. 11, pp. 399-405).—Following a discussion of the work of others on the action of so-called radioactive fertilizers, a series of plat and field experiments is described in which a fertilizer supposed to have radioactive powers was tested on grains, alone in different amounts and mixed with one or more different common fertilizers.

When used alone on grain at rates of 75, 100, and 150 kg. per hectare (67, 89, and 134 lbs. per acre) the largest application had a marked depressing effect. A small increase in yield was obtained with the smallest application, but this was considered to be within the limits of experimental error. When

used with mixtures of common fertilizers the best results were obtained where the common fertilizers together constituted a complete fertilizer mixture, and the difference between these results and those obtained when a complete fertilizer was used alone were small. While seemingly a slight benefit resulted from the use of the radioactive fertilizer in combination with a complete fertilizer mixture, the author apparently is not prepared to conclude that this benefit is a result of the catalytic or radioactive influence of the fertilizer. He expresses doubt as to the value of such materials and suggests that the subject requires further study.

Composition of filter press (lime) cake, S. F. SHERWOOD (*U. S. Dept. Agr., Dept. Circ. 257 (1923), pp. 3*).—Analyses of a number of samples of filter press cake produced in the process of the manufacture of beet sugar are presented and discussed. The samples included fresh cake and weathered material from masses about a year old.

No marked differences were found between the contents of potash, phosphoric acid, ammonia, and calcium in the fresh and the weathered cake. The figures also indicate that 1 ton of average material containing 20 per cent of water will yield approximately 4.5 lbs. of ammonia, 8.5 of phosphoric acid, 3 of potash, 740 of calcium oxid, and 150 lbs. of organic material. Thus the calcium carbonate in 1.5 tons of average filter press cake containing 20 per cent of water would be equivalent to the calcium carbonate in 1 ton of high-grade ground limestone. While the dry material of filter press cake is thought to afford a satisfactory material for the liming of soils, it is stated that the other fertility constituents, particularly phosphoric acid, are not necessarily in available form.

AGRICULTURAL BOTANY.

Proof of the power of the wheat plant to fix atmospheric nitrogen, C. B. LIPMAN and J. K. TAYLOR (*Science, 56 (1922), No 1456, pp 605, 606*).—The authors claim that wheat plants, under the conditions of their experiment, showed power to fix large quantities of nitrogen from the air. Plants were grown in series in jars containing Shive solution, most of the plants being harvested at the expiration of six weeks, but some of those which received no nitrogen were allowed to produce seed. As a result of the cultures it is shown that in a number of series of wheat plants grown without nitrogen and with varying quantities of nitrate, definite evidence was adduced that all the wheat plants fixed nitrogen from the air. Excluding the nitrogen content of the culture solutions at the end of the experiment, there was a gain of nitrogen from the air which varied in different series of from 13 to 21 per cent of the total amount of nitrogen found in the plant.

A series of experiments with barley is reported in progress, and while the experiments are not complete, it is believed that they will yield results similar to those obtained with wheat.

Mycorrhizas of coniferous trees, W. B. McDUGALL (*Jour. Forestry, 20 (1922), No. 3, pp. 255-260, figs 3*).—Based on material collected at Bar Harbor, Mount Desert Island, Me., 1921, these studies add two generic determinations to the list of fungi known to form ectotrophic mycorrhizas. Both of these belong to the genus *Cortinari*. One of these showing a yellow mycelium is found on red spruce, balsam fir, and yellow birch, and the other showing white mycelium is found on red spruce, balsam fir, and white pine. The structural characteristics of the yellow mycorrhizas of red spruce and the white mycorrhizas of balsam fir are given. A unique tubercle-like compound mycorrhiza

of white pine seedlings is described and figured in cross section. No evidence was found to favor the hypothesis that the ectotrophic mycorrhizal fungi are of considerable benefit to the host plants by aiding them in absorbing materials from the soil. Ectotrophic mycorrhizas appear to be representative cases of antagonistic nutritive conjunctive symbiosis.

The fungus tissue of an ectotrophic mycorrhiza suggests strongly the tissue of a sclerotium, which is a structure in which food is stored in preparation for the production of fruit. It is regarded as probable that, in a sense, the mycorrhiza takes the place of a sclerotium, and as possible that the tubercle-like bodies described in this paper are due to a greater tendency to sclerotia formation in the fungus concerned than is true of most mycorrhizal fungi.

Growth studies.—I, A quantitative study of the growth of roots, J. H. PRIESTLEY and A. F. C. H. EVERSHERD (*Ann. Bot. [London]*, 36 (1922), No. 142, pp. 225-237, figs. 6).—The aim of this work was to obtain data for plant growth based upon mass measurements, with a view to ascertaining whether the subsequent analysis of such data would be of value in throwing light upon the inner mechanism of growth.

The experimental results, as obtained from studies on *Tradescantia* and tomato, are presented in tabular and graphical form with discussion.

Growth studies.—II, An interpretation of some growth curves, J. H. PRIESTLEY and W. H. PEARSALL (*Ann. Bot. [London]*, 36 (1922), No. 142, pp. 239-249, figs. 4).—Data recorded above for root growth provide curves showing a series of successive inflexions of the S-type so often obtained in growth experiments. In a brief review of previous work, special attention is given to a comparison of this type of curve with that of an autocatalytic chemical reaction. It is pointed out that analysis of the physiological conditions involved at different stages of growth is apparently a necessary preliminary in the interpretation of such growth curves. Such an analysis is attempted for the growth of roots after previous consideration of the data available for yeast.

The early exponential portion of the curve is considered to represent the exponential increase in size of the apical meristem. The mass increase then becomes proportional to time, probably because the supply of root-forming material is delivered at uniform rate. The final decrease in growth is coordinated with the initiation of lateral meristems. It is shown that the hypotheses involved give an adequate explanation of the growth of roots at high temperatures as outlined by Leitch (*E. S. R.*, 35, p. 432), and permit certain assumptions as to the endogenous origin of lateral roots.

On the absorption of ions by the roots of living plants.—I, The absorption of the ions of calcium chlorid by peas and maize, G. M. REDFERN (*Ann. Bot. [London]*, 36 (1922), No. 142, pp. 167-174).—In view of the various results obtained by investigators named in experimentation on the absorption of ions by living plants, the author carried out this experimentation with pure strains of peas and maize, limited to the absorption of a single salt after being started in a modified Crone solution (*E. S. R.*, 18, p. 21), the concentrations used being $N/10$, $N/100$, $N/1,000$.

A result of evidence here tabulated gave support to the view that salt ions are unequally absorbed by roots of growing plants. The differences in absorption rate are greatly reduced in less concentrated solutions, being almost zero in very dilute solutions, which alone affect the plant under normal conditions. No evidence in support of periodicity in absorption was obtained. Equilibrium in the intake of this single salt by roots of living plants is reached within the first 24 hours of exposure to the salt solution in the case of peas, and within the first 48 hours with maize. Potassium and magnesium diffuse out from the

roots to replace the excess of calcium absorbed, which explains the fact that the H-ion concentration of the solution remained approximately the same.

Culture tests with nutritive solutions with particular reference to the importance of the manganese and hydrogen-ion concentration, F. WEIS (*K. Vet. og Landbohøjsk. [Copenhagen], Aarskr. 1919, pp. 239-280, figs. 17*).—Of the nutritive solutions bearing the names of Knop, Crone, and Hansteen Cranner, the author found (among other facts detailed) that with oats only the first and the last named gave satisfactory results, while with maize only the last gave good results, and this not in all instances. H-ion concentration showed clearly an influence on the morphological development of the roots. The most favorable H-ion concentrations to cultivated plants appear to lie between pH 4.5 and 6.

The curative influence of manganese in regard to oat dry spot does not appear to be due to the influence of acidity.

The effect upon permeability of the same substance as cation and anion, and changing the valency of the same ion, O. L. RABER (*Amer. Jour. Bot., 8 (1921), No. 9, pp. 464-470, figs. 2*).—Work bearing upon questions raised in the course of a study previously noted (*E. S. R.*, 47, p. 31) showed chromium to have a different initial effect upon the permeability of *Laminaria* depending upon whether it occurs in the cation or the anion of a salt. If in the latter the first effect is a decrease in resistance, and if in the former an increase. Ferric chlorid causes a greater increase in resistance than ferrous chlorid, independent of the H-ion concentration. The difference is thought to depend upon the valence.

Comparative studies on respiration.—XVIII, **Respiration and antagonism in Elodea,** C. J. LYON (*Amer. Jour. Bot., 8 (1921), No. 9, pp. 458-463, figs. 2*).—It is said that while previous studies in this series (*E. S. R.*, 48, p. 124) have dealt with the relation between antagonism and respiration, they have not included tissues of higher plants containing normal amounts of chlorophyll, the experiments reported by Thomas (*E. S. R.*, 41, p. 524) employing germinating seeds with little or no chlorophyll. The experiments here described as carried out with *E. canadensis* were designed to test the effects of mixtures of solutions of sodium and calcium chlorids on such tissues. It is stated that solutions of NaCl cause an increase in respiration followed by a decrease, while solutions of CaCl₂ cause only a decrease. After sufficient exposure both the solutions depress the respiration. In a mixture containing 99.65 mols of NaCl to 0.35 of CaCl₂ the rate remains normal, while a mixture of 98.62 mols of NaCl to 1.38 of CaCl₂ causes a great increase in respiration. The antagonism curve of NaCl v. CaCl₂ is unique in that it has two maxima.

The diffusion of sulphocyanic acid in plants, S. DEZANT (*Staz. Sper. Agr. Ital., 53 (1920), No. 12, pp. 438-450*).—In this portion of the present study (*E. S. R.*, 44, p. 825), dealing with a considerable number (23) and variety of plants, the author has found sulphocyanic acid only in the crucifers, 12 or 14 of these yielding the compound in question.

Pollen and pollen enzymes, J. R. PATON (*Amer. Jour. Bot., 8 (1921), No. 10, pp. 471-501*).—Although it has been assumed that pollen tubes digest their way through the style, little experimental evidence is obtainable as to the exact nature of this enzym action, histological examination showing that in most instances pollen tubes make their way between the walls of adjacent cells rather than through them. It would be natural to expect, therefore, to find most frequently not a cytase- or cellulose-digesting enzym, but rather a pectinase capable of digesting the pectin of the inner lamella. This has been shown to be the case in the experiments here noted.

Eighteen species of pollen have been tested for 13 kinds of enzymes. So far amylase, invertase, catalase, reductase, and pectinase have been found in all. Pepsin, trypsin, erepsin, and lipase have been found in some. Cytase was doubtfully identified in six of the eighteen. Tyrosinase and laccase have not been found in any, and zymase was found only in Siberian crab apple pollen.

The interrelationship of the number of the two types of vascular bundles in the transition zone of the axis of *Phaseolus vulgaris*, J. A. HARRIS ET AL. (*Amer. Jour. Bot.*, 8 (1921), No. 9, pp. 425-432, figs. 2).—An investigation was carried out regarding the interrelationship of the numbers of primary double bundles, intercalary bundles, and total bundles at the base of the hypocotyl in dimerous and trimerous seedlings of *P. vulgaris*, the results of which are detailed.

Area of vein islets in leaves of certain plants as an age determinant, M. R. ENSIGN (*Amer. Jour. Bot.*, 8 (1921), No. 9, pp. 433-441, pl. 1).—This is a continuation of previous work (E. S. R., 43, p. 133) with special reference to the premises and methods of Benedict (E. S. R., 34, p. 222). The author employed leaves of *Berberis vulgaris*, *B. thunbergi*, *Castanea dentata*, *Quercus alba*, *Fagus caroliniana*, *Vitis vulpina*, and *Vitis* sp.

The data obtained are considered to show that any study of leaf venation made from uncleared leaves is wholly unreliable, as the results herein presented do not show a single instance in which the leaf venation might be taken as an index of the relative ages of the plants in question. No correlation was evident between the ages as indicated by trunk diameters and leaf vein-islet area in the case of *F. caroliniana*, *C. dentata*, *B. vulgaris*, *B. thunbergi*, and *V. vulpina*.

Studies on the path of transmission of phototropic and geotropic stimuli in the coleoptile of *Avena*, H. A. PURDY (*K. Danske Vidensk. Selsk., Biol. Meddel.*, 3 (1921), No. 8, pp. 29, figs. 10).—Experimentation is described as carried out with *A. sativa* in studying the path of both phototropic and geotropic stimuli, in order to determine whether or not the position of the incision in relation to the source of illumination or gravity influenced the transmission of the stimulus. It is stated that when the plants are placed with the incision on the side of the coleoptile either farthest from the source of unilateral illumination or on the lower side in an exposure to geotropic stimulation transmission of the stimulus from the tip to the base is only slight. Discussion is offered regarding theoretical considerations involved or implied.

The leaf-skin theory of the stem: A consideration of certain anatomico-physiological relations in the spermatophyte shoot, E. R. SAUNDERS (*Ann. Bot. [London]*, 36 (1922), No. 142, pp. 135-165, figs. 34).—Having noted in *Matthiola incana* the sharp line of demarcation occurring between the completely glabrous hypocotyl and the felt-covered plumule, and having made a study of many spermatophyte seedlings, bringing to light certain anatomical and physiological relations appearing to furnish a clue to the different character of the axis above and below the cotyledon node, and probably to throw light on the nature of the shoot axis in general, the author has discussed herein systematically the accumulated evidences.

It is concluded that the surface tissue of the spermatophyte shoot axis is of foliar origin—that is to say, the leaves are decurrent not only in those types in which they obviously appear to be so but generally and probably universally throughout the group. This appears to be the case also in some at least of the Pteridophyta. In those species which develop a hypocotyl its superficial tissues are similarly derived from the cotyledons, and it is, therefore, to the cotyledons that we must look for an explanation of its external features.

This leaf skin is formed by a downward growth and extension of the leaf primordium, which keeps pace with the extension of the central axis in which it is fused. The contact edges of these extensions may be so adjusted or so deeply fused as to show no outward trace, or they may exhibit the characteristics of potential edges and be demarcated in various ways (by ridges, furrows, lines of hairs, or of color). Special cases are indicated.

The occurrence of adventitious exogenously formed buds on the hypocotyl (as in *Antirrhinum orontium*) appears to show that a shoot can be formed directly from foliar tissue at undifferentiated points without previous mutilation or other injury. Such buds may show a general flooding with anthocyanin in response to the different conditions existing in the embryonic tissue, while the parent axis has the coloring matter localized in a definite region.

Apogamy and hybridization in some composites and their bearing on the constancy of the forms. C. H. OSTENFELD (*K. Vet. og Landbohøjsk. [Copenhagen], Aarskr. 1919, pp. 207-219, fig. 1*).—Two species of *Antennaria* (*A. decipiens* and *A. rosea umbricata*), received as seeds from the Edinburgh Botanical Gardens in 1911, have during cultivation proved apogamous like North American and Greenland species of the genus. Within the subgenus *Archieracium*, the author obtained in 1911 one deviating individual from seeds of *Hieracium tridentatum*, this mutation proving constant from the start. Repetition of the experiment on a larger scale in 1916 gave out of 1,107 individuals 4 which appeared to deviate, but which have not been sufficiently tried as to hereditary conduct in regard to constancy. Mutations appeared to occur in the apogamous species of *Hieracium*. This fact must, it is thought, favor the preservation of the polymorphism within the genus.

On hybridization of some species of *Salix*, H. S. IKENO (*Ann. Bot. [London], 36 (1922), No. 142, pp. 175-191*).—Recapitulating his findings as previously noted (*E. S. R.*, 40, p. 540), the author outlines his later work, with conclusions in some detail.

Pollination of *S. multinervis* by *S. gracilistyla* gives hybrids as well as *S. multinervis* exactly similar to the mother plant. Two kinds of hybrids appear in F_1 . The one characterized by its densely hairy catkin is called the G-type; the other characterized by its less hairy catkin is called the M-type, the two being produced in the proportions of 83 and 17 per cent, respectively. The two are genetically equivalent though they differ externally. The genetic behavior is further outlined with discussion.

If parthenogenesis is derived phylogenetically from normal fertilization and if this transition is gradual, *S. multinervis* may perhaps be regarded as being in the way of such transition and in its very beginning. Neither abortion of pollen nor decline of sexuality is to be detected here, which contradicts the view often expressed that parthenogenesis arises in consequence of such circumstances. All plants of *S. multinervis* produced by apomixis are female. An explanation is offered.

The formation and pathological anatomy of frost rings in conifers injured by late frosts, A. S. RITGADS (*U. S. Dept. Agr. Bul. 1131 (1923), pp. 16, pls. 6*).—A study was made of the pathological anatomy of late-frost injury in a number of species of coniferous trees, the material being collected for the most part in the Northwestern States.

It is claimed that young shoots injured by late frost may either wilt through loss of turgor, or they may be killed outright and replaced by volunteer shoots. The structural disturbances initiated by the action of late-frost injury is not confined to the shoots then developing, but extends down the stem sometimes for a considerable distance below the base of the injured shoots, or as far as the cambium has been injured by freezing without entailing the death of the

stem. The healing process results in the formation of a brownish zone of parenchyma wood within the growth ring.

Late-frost injury is said to result in characteristic disturbances in the tissue of the growth ring forming at the time of the injury.

Frost-ring formation may occur in the wood as the result of either late or early frosts during the growing season, or from the freezing of the cambium when the tree is dormant. Such injury results in weakness of the wood.

The freezing temperatures of some fruits, vegetables, and cut flowers, R. C. WRIGHT and G. F. TAYLOR (*U. S. Dept. Agr. Bul. 1133 (1923), pp. 8*).—On account of the demand for exact data regarding the temperatures at which various products freeze, the authors made freezing-point determinations of a large number of fruits, vegetables, and cut flowers, and the maximum, minimum, and average temperatures at which ice was formed in the tissues are stated. These temperatures are considered as danger points at which it is unsafe to hold produce for any length of time, as serious danger of frost injury exists.

Some experiments on the action of wood on photographic plates, H. S. WILLIAMSON (*Ann. Bot. [London], 36 (1922), No. 141, pp. 91-100, pl. 1*).—The present investigation was undertaken to ascertain whether the previously recognized action of certain woods on photographic plates provides a suitable method for determining early the incidence of decay, for recognizing kiln-dried wood, or for the identification of timbers. In none of these respects did the results appear sufficiently consistent and reliable for the purpose in question, except that (barring a few cases of reversal in Scotch pine) it was possible by the photographic method to confirm the division of the pines into two groups, as already indicated by morphological features.

The southeast African flora: Its origin, migrations, and evolutionary tendencies, J. W. BEWS (*Ann. Bot. [London], 36 (1922), No. 142, pp. 209-223*).—Southeast Africa has a flora composed of a tropical-subtropical element and a temperate or mountain element. The study here indicated of various lines of migration throws light on the origin of these elements and also on many questions of evolutionary history.

While it is considered advisable not to attempt to derive the temperate flora as a whole from the tropical, or vice versa, examples are given of tropical genera producing species which have invaded temperate regions, as *Rhus*, and of temperate genera which have invaded the Tropics, as *Pelargonium*.

Inventory of seeds and plants imported by the Office of Foreign Seed and Plant Introduction during the period from January 1 to March 31, 1920 (*U. S. Dept. Agr., Bur. Plant Indus. Inventory No. 62 (1923), pp. 96, pls. 8*).—Descriptive notes are given of 672 items of seeds and plants introduced during the period covered by this inventory.

FIELD CROPS.

Report on the work of the experiment station of the Swedish Seed Association at Holm for the 5-year period 1917-1921, G. ERICSSON (*Sve-riiges Utsädesför. Tidskr., 32 (1922), No. 4, pp. 184-209, figs. 3*).—The results of comparative tests of varieties of rye, wheat, barley, oats, and peas are reported in detail in tabular form for each year of the period. The varieties tested were, for the most part, newly originated sorts, and data on their yielding capacity, length of growing period, winter hardiness, and quality of grain are presented and discussed. Brief historical notes on the culture of the different crops are included.

The average results of four years showed that among 11 varieties No. 0476, a strain of Norrland rye, ranked first in yield, with 66.9 bu. per acre, or 23.9

per cent above the yield of the check variety. This strain also stood first in the yield of straw, with 7,108.7 lbs. per acre, or 11.6 per cent above the straw production of the check variety. It had an average growing period of 363 days, being one of the earliest varieties in the test, and also showed a high degree of winter resistance. On the basis of its performance, it is considered the best of the varieties under trial.

Among 6 varieties of selected and improved strains of winter wheat, compared for five years with Sammettsvete as a standard, No. 0760, a strain of Värmland wheat, produced the best average yield, 52.58 bu. per acre. The strain ranking next in yield was No. 0762, originated from Västernorrland wheat, which produced 49.23 bu. per acre. The average yield per acre of Sammettsvete, the check variety which stood third, was 48.52 bu. No. 0760 also ranked first in straw production with 3.17 tons per acre, being followed by Sammettsvete with 2.90 tons per acre. In winter resistance Sammettsvete gave the best results and was followed in their order by No. 0762 and No. 0760. The lowest degree of winter resistance was exhibited by No. 0825, Thulevete II. The growing period of all the varieties ranged from 369 to 372 days.

Experiments with 11 varieties and strains of barley showed that the highest average yield, 56.93 bu. per acre, was secured from No. 123-09, a strain of six-rowed barley which produced 11.1 per cent more grain than a common standard variety grown in comparison. No. 17-09 F produced 55.54 bu. per acre, which was 8 per cent above the yield of the check variety. The growing period of these two varieties was 85 and 84 days, respectively, and the range for all the varieties in the test was from 80 to 88 days. Vega barley, which stood third in the yield, stood first in strength of straw. In comparison with two two-rowed varieties, Vega, a six-rowed sort, was equal in yielding capacity to Gull and superior to Svanhals barley, as indicated by the average results for three years, but in straw production as well as in bushel weight of grain it was exceeded by these varieties. Maskin barley, a Norwegian variety, did not prove superior to Vega barley, with which it was grown in comparison for three years.

Of 13 varieties of oats tested for five years, No. 01163 d, a strain from a recent crossbred sort, ranked first with an average yield of 92.48 bu. per acre, which was 26 per cent above the yield of White Nordsvensk, with which all varieties were compared. The varieties or strains ranging next were No. 01163 b, a strain of Odal; No. 0386, a strain of Guldregn; and No. 01104, a strain of Orion oats, which produced 11.8, 11.7, and 10.8 per cent more than the check variety, respectively. The growing period of the different varieties varied from 88 days for Mesdag to 100 days for No. 01143. The kernel constituted 73 per cent of the grain in No. 0386, indicating the smallest percentage of hull, and 68.5 per cent in White Nordsvensk with the largest percentage of hull of the varieties tested. In another series of tests in which several varieties were compared with Guldregn oats only Seger exceeded the check variety in the production of grain.

Six varieties of peas were tested for five years. No. 0123, a new variety of yellow peas originated at Svalöf, gave the best yield, 33.23 bu. per acre, which was 12.5 per cent above the yield of the check variety, Henderson First of All. The best yield of vines, 4,303 lbs. per acre, was produced by Ångermanland Gröärt, while No. 0123 yielded only 2,930 lbs. per acre. The growing period of the varieties ranged from 96.4 days for No. 0123 and No. 0124, also originated at Svalöf, to 101.6 days for the Ångermanland Gröärt.

For five years an experiment was in progress with different crops to determine their relative productive capacity. The average results of all varieties of the different crops showed that winter rye stood first with a grain yield

of 3,151.4 lbs. per acre, winter wheat second with 2,624.8 lbs., oats third with 2,477.6 lbs., and barley last with 2,233.9 lbs. of grain per acre. It is pointed out that when the results with oats and barley are diminished by the hull content of their grains, oats instead of barley will occupy the last place.

[Field crops work of the Agricultural Research Institute, Pusa, 1921-22], A. and G. L. C. HOWARD, C. M. HUTCHINSON, G. S. HENDERSON, and K. D. NAIK (*Agr. Research Inst., Pusa, Sci. Rpts., 1921-22, pp. 9-16, 20, 21, 39, 68-71, 88-92*).—The progress of earlier work is described (E. S. R., 46, p. 727).

Indigo plants were successfully inoculated with nodule bacilli isolated from pea, cowpen, and fenugreek, which in turn were effectively inoculated with the indigo nodule bacillus. Fertilizing indigo plants with nitrate retarded or entirely suppressed nodule formation.

Food production in Malaya, F. G. SPRING and J. N. MILSUM (*Fed. Malay States Dept. Agr. Bul. 30 (1919), pp. 112, pls. 12*)—A discussion of environmental conditions in the Federated Malay States and general agricultural practices suitable to the growing of field crops. Specific instructions are given for the production of cereals, grasses, legumes, and root crops.

How to grow alfalfa, R. A. OAKLEY and H. L. WESTOVER (*U. S. Dept. Agr., Farmers' Bul. 1283 (1922), pp. 11-36, figs. 10*).—This supersedes Farmers' Bulletin 339 (E. S. R., 20, p. 634), rearranging and revising the information given.

Results of cotton variety tests (*Alabama Sta. Circ. 47 (1923), pp. 9*).—The tabulated results of varietal tests with cotton between 1914 and 1922 show early or medium early varieties to lead in north Alabama, with Cook 1010, King, Trice, Bottoms, and Acala preferred. On wilt-free land in central and south Alabama, Cook selections, Cleveland and Toole strains, College No. 1, and Acala are indicated, whereas on land infected with wilt in these sections only wilt-resistant varieties, particularly Cook 307-G, resistant strains of Toole, Dixie-Triumph, and Dixie-Cook, should be planted.

Cotton experiments, 1922, J. F. O'KELLY and R. COWART (*Mississippi Sta. Circ. 45 (1922), pp. 7*).—Lone Star with 409 lbs. of lint per acre, Cleveland (Wannamaker) 409 lbs., and Miller 393 lbs. averaged highest in 5 years' tests at the station (E. S. R., 47, p. 632). Delfos, Express, and Lone Star led in acre values. Acala and Lone Star led in values in the 1922 test of standard varieties; D. & P. L. No. 3, Acala No. 5, and Delfos 698 in the comparison of standard and recent varieties; and Trice and Delfos selections on hill land. Covington-Toole, Tri-Cook, and Cleveland×Lewis 63 exhibited the greatest wilt resistance in a test on infected soil. Ammonium sulphate and sodium nitrate made the highest and about equal net gains in tests of nitrogenous fertilizers for cotton.

Annual report of the secretary, Indian Central Cotton Committee, Bombay, for the year ending August 31, 1922, B. C. BURT (*Indian Cent. Cotton Com., Bombay, Ann. Rpt. Sec., 1922, pp. 73*).—The activities of the organization concerning the marketing of and research with cotton in India are outlined for the year indicated.

Torsion constant of cotton hair, J. B. VINCKERS (*Textielindustrie, 3 (1922), pp. 253-258; abs. in Agr. Jour. India, 17 (1922), No. 6, pp. 626, 627*).—A measurement of the force required to break a single fiber by twisting, assumed to be of practical value, is determined by fixing the fiber in a rotating clamp such as in the Schopper twist apparatus, and counting the necessary revolutions. It is shown that torsion×diameter is a constant. This may be further elaborated into the formula: $c = \text{torsion} / \sqrt{N}$, where N is the number (length in

meters per gram) of the fiber. The torsion constant so derived with cotton was found to be 350 per meter, silk 248, sisal 221, manila 218, Lincoln wool 214, Dutch hemp 141, blue flax 130, artificial silk 125, and jute 64.

The diameter of yarns, J. A. MATTHEW (*Jour. Textile Inst.*, 12 (1921), No. 12, pp. 469-472, fig. 1).—The diameter of a yarn is shown to be inversely proportional to the square root of the count multiplied by the apparent density of the yarn. Filling the air spaces of the yarn with oil of low viscosity, removing the excess oil, and immersing the yarn in a graduated cylinder of water gives a measure of the volume of the fibers. Then the apparent density equals the weight of the sample in grams divided by the volume of the oiled sample in cubic centimeters.

That the diameter of yarns of the same count may vary appreciably according to the source and nature of the material is shown by results obtained with the above method. A slight increase of diameter is apparent as the twist increases. Since the apparent density reaches a minimum value, after which it increases, there is probably a critical twist factor (about 1.65 to 1.7) at which the yarn attains a smooth surface and a full appearance.

The following apparent densities of yarn of untreated fiber were determined: Hemp, middles 0.92, tops 0.91, roots 0.91; half hemp and half flax 0.94; mixed flax 0.99; Oregon flax 0.98; Russian dew-retted flax 0.88; Irish dew-retted flax 0.90; hemp and ramie mixture 0.86; and Egyptian cotton 0.62.

Results of fertilizer tests with potatoes grown in New Jersey, W. H. MARTIN (*Seed World*, 13 (1923), No. 2, pp. 26, 27, figs. 2).—Fertilizer experiments with potatoes by the New Jersey Stations in cooperation with the U. S. Department of Agriculture are described, with recommendations for general practice.

Studies of 21 fertilizer mixtures indicated the need of a balanced fertilizer for the production of maximum yields. Yields were about the same with both Irish Cobbler and American Giant varieties, where the nitrogen was all derived from an inorganic source or equally from organic and inorganic sources. Very little difference in yield was noted between the plats treated with sodium nitrate and with ammonium sulphate, but increased scab accompanied the extensive use of sodium nitrate.

Observations on the technique required in field experiments with rice, H. W. JACK (*Fed. Malay States Dept. Agr. Bul.* 32 (1921), pp. 81, pls. 2).—Preliminary experiments to determine the optimum size of small plats for accurate breeding experiments with rice are reported, with a description of the cultural methods of the Malay with the crop. The results indicated respective probable errors of ± 6 , ± 4 , and ± 3 per cent for plats of 20 ($\frac{1}{160}$ acre), 40 ($\frac{1}{80}$ acre), and 80 ($\frac{1}{40}$ acre) plants under average dry harvest conditions, and ± 8 per cent for plats of 40 ($\frac{1}{80}$ acre) under wet harvest conditions.

Wet paddy planting in Negri Sembilan, D. H. GUEST (*Fed. Malay States Dept. Agr. Bul.* 33 (1922), pp. 93, pls. 6).—The areas and yields of rice in the State are indicated, with notes on water supply, cultural methods, and the causes of low yields. Studies of the probable error in rice experiments have been noted earlier (E. S. R., 40, p. 336).

Rice requiring six months for maturity made its greatest growth in the third and fourth months, and a spacing of two plants per hill with hills 1 ft. apart gave best results. The data indicate that rice with a short maturation period means small crops. The dry fertilized and wet unfertilized nurseries gave yields about equal, whereas returns from wet fertilized and dry unfertilized nurseries were comparable but decidedly less than the first mentioned.

Rock phosphate applied at transplanting materially increased the yields and growth of paddy, while superphosphate produced no increase. Sodium

nitrate applications at flowering time were without benefit, whereas the reverse was noted with potassium sulphate.

Detailed botanical and agronomic notes are tabulated for Malay hard and soft rices and Siamese and Sumatra varieties, and analyses of Malay and Siamese varieties are included. Apparently the composition bears no striking relation to the maturation period. Soil conditions, however, exercise a considerable influence. Milling tests indicate a distinct relation between the variety and milling quality, the Siamese and Sumatra varieties being generally superior to the Malay in this respect.

A new system of planting sugar cane, M. CALVINO (*Rev. Agr., Com. y Trab. [Cuba], 4 (1921), No. 3, pp. 500-503, figs. 3*).—Three-node cuttings of D 74, D 99, and D 108, Uba, and Cristalina, with all buds removed except those on the middle nodes, and planted with the bud facing upward according to the method of Kulkarni (*E. S. R.*, 40, p. 635), gave yields considerably in excess of those obtained from cuttings with three buds retained.

[The windrowing of] sugar cane (*Agr. Research Inst., Pusa, Sci. Rpts., 1921-22, pp. 27, 28*).—In continuing experiments on the windrowing of cane at Pusa (*E. S. R.*, 46, p. 730), P. B. Sanyal observed that the windrowed canes were thoroughly wetted by heavy rains, when deterioration of the cane was definitely and immediately established. During the previous season the windrowed canes received practically no rain and were in good conditions one month later. These results confirm conclusions at Peshawar (*E. S. R.*, 45, p. 343). Canes windrowed in December, 1921, and receiving 0.85 in. of rain deteriorated much more than those windrowed a month later and receiving only 0.52 in.

Coimbatore sugar cane seedlings in the United Provinces, G. CLARKE and S. C. BANERJEE (*Agr. Jour. India, 17 (1922), No. 5, pp. 445-462*).—Rigorous tests of seedlings from Coimbatore (*E. S. R.*, 44, p. 636) produced only one cane of merit, Co 214, which was characterized by early maturity, high yield, and good sucrose content.

History and seed production of purple vetch, R. McKEE (*U. S. Dept. Agr., Dept. Circ. 256 (1923), pp. 5, fig. 1*).—A brief chronological account of the introductions, experiments, and seed production of purple vetch (*Vicia atropurpurea*), particularly in the Pacific Coast States.

Spring wheat production in eastern Wyoming, A. L. NELSON (*Wyoming Sta. State Farms. Bul. 1 (1920), pp. 3-12*).—Results of varietal, cultural, and date and rate of seeding trials at the Cheyenne Experiment Farm in co-operation with the Office of Cereal Investigations, U. S. D. A., during the years 1913-1920, inclusive, are reported as applicable to the part of the State east of the Rocky Mountains. The average precipitation, 15.17 in., of which over three-fourths occurs in the growing and maturing period of the crop, is deemed sufficient for profitable yields. See also an earlier note by Parsons (*E. S. R.*, 40, p. 636).

Erivan, averaging 19.5 bu. per acre, and Kubanka and Acme, with 19.7 bu., were the highest yielding common and durum wheats, respectively, and possessed good milling and baking qualities. High yields and rust resistance appeared to be closely correlated. Late April and early May seedlings have given the highest average yields. A 3-pk. rate is recommended. Seeding in disked corn stubble is deemed the most economical method of production.

Winter wheat production in eastern Wyoming, A. L. NELSON (*Wyoming Sta. State Farms Bul. 2 (1920), pp. 15-22*).—Experiments with winter wheat at the Cheyenne Experiment Farm from 1913 to 1920, inclusive, are reported. Precipitation in eastern Wyoming is thought sufficient to produce good average

yields of winter wheat. While soil blowing is sometimes injurious to the crop, it may be controlled by leaving the land rough or by seeding in stubble.

Winter wheat seeded in the stubble of a spring cereal produced the highest average yields. Spring crops to be followed in this manner by winter wheat should mature early and without an aftergrowth. Seedings should be made about September 1 at rates of 3 to 4 pk. per acre on fallow and up to 5 pk. on stubble. Kanred produced the highest 3-year average yield, 19.5 bu. per acre, and was the most rust resistant of the varieties compared.

Natural hybridization of wheat and rye in Russia, G. K. MEISTER (*Jour. Heredity*, 12 (1921), No. 10, pp. 467-470).—Mass appearance of natural F_1 hybrids between wheat and rye was observed at the Saratov, Russia, Experiment Station in plats of *Triticum vulgare erythrospermum*, *T. vulgare hostianum*, and *T. vulgare pyrothrix*, winter wheat varieties. The plats in which many hybrids occurred were characterized by early ripening, by simultaneous or partially coincident flowering with rye, and with a considerable opening of the flower glumes in blooming. The great number of hybrids, 20 per cent of the plants in a plat of *T. vulgare erythrospermum* which was characterized by low frost resistance, may be attributed to the biological peculiarities of the variety. Its F_1 hybrids, on the contrary, resemble rye in frost resistance.

Botanically, the F_1 wheat-rye hybrids are intermediate between Secale and Triticum in most of their features, with a tendency to the wheat habit. Since self-pollination did not take place in the hybrids, the seed found in their spikes might be due to pollen from either wheat or rye. Notes are given on the succeeding hybrid generations and their resistance to frost and *Fusarium nivale*.

Eighth report of the Montana grain inspection laboratory, C. McKEE, W. O. WHITCOMB, and R. E. KELLOGG (*Montana Sta. Bul.* 149 (1922), pp. 24, fig. 1).—The activities of the laboratory (E. S. R., 44, p. 143) are outlined for the biennium ended June 30, 1922. A total of 7,289 samples of agricultural seeds were tested for purity and germination, and 1,947 samples of grain were inspected for grade and dockage.

Comparisons gave general indications that a laboratory test (E. S. R., 46, p. 732) of well-aged field crop seeds will indicate within 75 per cent the proportion of seeds in a given lot that will produce healthy plants under normal field conditions. Newly threshed winter wheat showed dormancy when tested by ordinary laboratory methods, but not when tested by special laboratory methods or when planted in the field. Similar results were secured with spring wheat, oats, and barley.

Alfalfa seed of normal color germinated 55 per cent higher in the laboratory than brown seed and 33 per cent higher than green seed from the same samples. Sweet clover seed of normal color germinated slightly better than green seed from the same samples in both laboratory and field tests.

Results of seed tests for 1922, M. G. EASTMAN (*New Hampshire Sta. Bul.* 207 (1922), pp. 16).—Tables show the percentage of purity and germination of 301 official samples of agricultural seed collected during the year ended June 1922.

HORTICULTURE.

A home vegetable garden, E. M. FREEMAN (*New York: Macmillan Co.*, 1922, pp. VI+214, pls. 8).—This text, second in the series previously noted (E. S. R., 46, p. 735), presents in a popular manner information relating to the establishment and care of a vegetable garden.

The California vegetables in garden and field, E. J. WICKSON (*San Francisco: Pacific Rural Press*, 1923, 5. ed., rev., pp. 319, pls. 23, figs. 6).—A fully revised and reset edition of the work, previously noted (E. S. R., 38, p. 343).

Pollination studies with root crops, E. JENSEN (*K. Vet. og Landbohøjsk. [Copenhagen]*, *Aarskr.* 1921, pp. 180-217, figs. 6).—This Danish paper, with a brief English summary, deals with pollination studies conducted with various root crops during the summer of 1917 at the Royal Agricultural College, Copenhagen.

Examination of the character of seed obtained as a result of self- and cross-pollination indicated that cross-fertilization is the normal procedure in the majority of the root crops studied. The two exceptions were the Swede turnip, which set seed so freely when inclosed in gauze hoods that the author concludes that selfing must be common in the plant in nature, and the parsnip, which also formed abundant seed under similar conditions. It is believed, however, that the parsnip, on account of its peculiar blossoming character, is adapted for cross-pollination. Blooming began with protandry, followed by a short mixed stage, in turn succeeded by a long female period. Selfing proved unsatisfactory in the mangel, sugar beet, turnip, carrot, and chicory, and in the last named plant resulted in the complete absence of seed. In work with the sugar beet and mangel the author found that a higher percentage of seed was obtained upon the main stem than upon the lateral branches.

Market nursery work series, F. J. FLETCHER (*London: Benn Bros., Ltd.*, 1921, vols. 1, pp. [4]+75, figs. 16; 2, pp. [4]+72, figs. 13; 1922, vols. 3, pp. [4]+72, figs. 27; 4, pp. [2]+68, figs. 20; 5, pp. [5]+73, figs. 29; 6, pp. [5]+68, figs. 25).—A series of small handbooks on the culture of indoor and outdoor flowers, vegetables, and fruits. The titles of the volumes are as follows: Glasshouses and the Propagation of Plants, Special Glasshouse Crops, Roses for Market, Carnations and Pinks, Orchard Fruit Tree Culture, and Decorative Plants, Trees, and Shrubs.

Trees and shrubs hardy in the British Isles, W. J. BEAN (*London: John Murray*, 1921, 3. ed., [rev.], vols. 1, pp. XVI+688, pls. 36, figs. 122; 2, pp. VI+736, pls. 28, figs. 136).—In this third edition of the work previously noted (*E. S. R.*, 32, p. 337), brief technical descriptions are given of all the trees and shrubs, both indigenous and exotic, found growing in the British Isles.

Fruit breeding investigations, G. T. SPINKS (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt.*, 1921, pp. 33-41).—Continuing a series of reports (*E. S. R.*, 16, p. 39) upon fruit breeding activities at the Long Ashton Station, records are presented of the parentage of various crosses made during the year 1921. Observations upon the F_2 plants of eight tomato crosses emphasize the inheritance of size, shape, and color characters in the fruit and size and shape in the truss. In a few instances seed was saved of desirable plants.

Some observations on the extent of root development in mature fruit trees, G. S. PEREN (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt.*, 1921, pp. 21-32).—Data are presented in this paper on the length and the depth of penetration of roots of mature cherry, apple, and plum trees grown at the Long Ashton Station.

It was found that fruit tree roots extend to a much greater distance from the base of the tree than is usually believed, and it is pointed out that this information may have a direct bearing on the manner of distributing manures and fertilizers, which materials are frequently applied on a restricted area surrounding the immediate base of the tree. The major portion of the root systems examined were located in the top 20 in. of soil. The sudden change from a horizontal to a downward course observed in some roots is believed to be due to such possible causes as lack of water, toxic areas of soil, or close competition with roots of neighboring trees.

The apple industry of Pennsylvania, compiled by R. D. ANTHONY and J. H. WARING (*Penn. Dept. Agr. Bul.* 369 (1922), pp. 205, figs. 46).—A comprehensive

report upon production and marketing, based on an extensive survey conducted by the Pennsylvania State College and the State Department of Agriculture.

[**Grape investigations at the State Experiment Orchard, Berri, River Murray**], G. QUINN and C. G. SAVAGE (*Jour. Dept. Agr. So. Aust.*, 26 (1922), No. 5, pp. 409, 410, 412-414, 416-418, 420-422).—This paper, comprising the second part of the third annual report of the station (*E. S. R.*, 47, p. 339), presents detailed, tabulated results of fertilizer and pruning tests with various varieties of vinifera grapes.

An introductory note on the history and development of the raspberry, E. A. BUNYARD (*Jour. Pomol. and Hort. Sci.*, 3 (1922), No. 1, pp. 5, 6).—This is a brief historical sketch relating to the development of the cultivated European raspberry.

Commercial raspberries and their classification, N. H. GRUBB (*Jour. Pomol. and Hort. Sci.*, 3 (1922), No. 1, pp. 11-35, pls. 6).—This contribution from the East Malling Research Station presents the results of a 4-year study of raspberry varieties, in which it was found that considerable confusion exists regarding nomenclature. Furthermore, certain varieties were found to be composed of distinct strains which often differed markedly in their productive capacities. In the Baumforth Seedling, for example, on the basis of 100 for Pyne Royal, the most productive sort, one strain, B, yielded 85 and another strain, C, yielded only 58. Growth characters, notably the pubescence of the upper portion of the young growing canes, were found to be reliable means of identification when used in connection with observations on the fruits. The pubescent character was so clearly defined that the author was able to classify all varieties into two groups, glabrous and pubescent. The color of the spines was also found to be constant and to aid in identification. Observations upon wild raspberries indicated that the presence of both glabrous and pubescent canes is a natural characteristic.

The author presents a classification of varieties based on his observations, accompanied by technical descriptions of 40 varieties and strains. In the Antwerp, for example, seven distinct types were isolated.

A note on the impurity of raspberry stocks, N. H. GRUBB and G. S. PIREN (*Jour. Pomol. and Hort. Sci.*, 3 (1922), No. 1, pp. 7-10).—A study of raspberry collections at the East Malling and University of Bristol Research Stations showed that many varieties are misnamed or consist of one or more superficially similar kinds. It is thought probable that in many instances seedlings arising from fallen fruit contribute to the impurity of stock. Accidental inclusion of one or more plants of a variety naturally prolific in cane formation may easily lead to the entire replacement of the original kind. Very few, if any, of the multiple forms are deemed to be of bud variation origin. Tabulated lists included in the text show clearly the indiscriminate use of names; two varietal designations, Baumforth Seedling and Red Antwerp, were each found to be applied to eight distinct varieties, and many varieties, including Bath Perfection and Baumforth Seedling B, were found to be incorrectly named in many instances.

[**Experiments with limes**] (*West Indies Imp. Dept. Agr., Dominica Agr. Dept. Rpt.*, 1920-21, pp. 24-28).—Continuing earlier reports (*E. S. R.*, 46, p. 40), information is presented on four seasons' yields of limes grown on five 0.25-acre plots subjected to different manurial treatments. A summation of the data for the four years shows the following yields: (1) Complete fertilizer, 321 bbls., (2) control 243, (3) mulch 290, (4) nitrogen and phosphoric acid 320, and (5) nitrogen and potash, 293 bbls. In all cases the application of fertilizers gave profitable returns, a fact that is deemed especially significant because of

the age of the trees, which at the time of the experiment were in a full measure of youthful vigor.

The larger yields obtained from common limes budded on sour orange stock than from similar trees on their own roots indicated that budding stimulates increased yield.

Citrus fruits of Japan, T. TANAKA (*Jour. Heredity*, 13 (1922), No. 6, pp. 242-253, figs. 3).—This paper discusses the various species and varieties of citrus fruits grown in Japan, with notes regarding introduction and origin. The occurrence of mutations in Satsuma varieties is again discussed (E. S. R., 47, p. 143).

The curuba, W. POPENOE (*Colombian Rev.*, 1 (1921), No. 9, pp. 204, 205, figs. 2).—The fruit of this species, *Tacsonia mollissima*, is used in Colombia in the preparation of sherbets and other desserts, and the plant is deemed by the author to be worthy of culture in southern California and Florida.

The Saily date of Egypt, S. C. MASON (*U. S. Dept. Agr. Bul.* 1125 (1923), pp. 36, pls. 8, figs. 4).—Following a general discussion relating to the history, geography, and general status of date culture in Egypt, the author presents information concerning the introduction of the Saily date into the United States. The first offshoots of this promising variety were received in 1901 under the name Oga de Bedrichen, and since that time various importations have been received under different varietal designations. A comparison of authentic Saily plants received from the Kharga Oasis with plants from the vicinity of Gizeh showed that the two lots were identical. The author believes that this information will greatly favor the rapid introduction of this desirable date variety into the United States on account of the large number of orchards in the vicinity of Gizeh and the comparative ease of approach. The Saily date is especially valuable on account of the large size, superior quality, high sugar content, and the good keeping and shipping characters of the fruits. Furthermore, the tree is productive and easily propagated. Information is presented on the temperature and humidity requirements of this date variety.

An orchard of chestnut hybrids, J. A. DETLEFSEN and W. A. RUTH (*Jour. Heredity*, 13 (1922), No. 7, pp. 305-314, figs. 7).—Observations in a 175-tree orchard of F_2 chestnut hybrids (*Castanea japonica* \times *C. americana*) revealed a wide range of segregation ranging in various gradations between the two original parents. The F_2 trees were very uneven in growth and size, varying from 8 to 20 ft. in height at 14 years of age. None showed the extreme vigor or the precocity of the F_1 generation. Unlike the nuts of the F_1 trees, which were intermediate in size between the American and the Japanese parent, those of the F_2 were extremely variable, some being as small as those of the American parent and others as large as those of *C. japonica*. Most of the trees yielded burs containing three nuts. In respect to attachment of nuts to the bur, the F_2 trees varied from fully free to very tight in the following proportions: 50 per cent free, 44 per cent intermediate, and 6 per cent tight. Bur characters were extremely variable in the F_2 generation in respect to thickness, length of spines, etc. With one striking exception the F_2 trees, like those of *C. japonica*, produced nuts highly resistant to the weevil. It is believed that the segregation and recombination occurring in this cross are largely based on multiple factors. Attempts to top-work undesirable F_2 trees to the original F_1 parent were for the most part unsuccessful, only 3 per cent of the grafts forming satisfactory unions.

The pecan in Texas, J. H. BURKETT (*Tex. Dept. Agr. Bul.* 73 (1922), pp. 146, pl. 1, figs. 59).—A compilation of general information relating to soils, propagation, establishment and care of orchards, control of insects and diseases, and marketing operations.

FORESTRY.

Handbook of forestry (*Vade-mecum du Forestier*. Besançon: Soc. Forest. Franche-Comté et Belfort, 1921, pp. VII+192, figs. 10).—This is a small pocket edition containing tables and miscellaneous useful information for the practical forester.

Results of an experiment in reproducing hardwood stands under the shelter-wood method, W. D. DURLAND (*Jour. Forestry*, 20 (1922), No. 8, pp. 869-871).—As a result of observations prior and subsequent to the clear cutting in 1921 of four sample plats of oak located on different types of soil near New Haven, Conn., the author concludes that satisfactory yields of hardwood lumber can not be produced on inferior sites in 75 years—the age of the stands at the time of cutting, but can be produced on good soils. It is deemed probable that inferior sites may be better adapted to the growing of white pine.

Sufficient reproduction, both seedling and sprout, was present at the commencement of observations in 1906 to have fully restocked the area. As a result of clear cutting in 1921, reproduction was increased by the formation of sprouts. However, with the exception of chestnut, exterminated by disease, reproduction following clear cutting has perpetuated the subtypes observed in 1906. Since the greater part of the reproduction originated prior to 1906 under the shelter of the old stand, the author believes that the shelter-wood method may be successfully used in regenerating the various subtypes of oak represented on the plats.

Tree culture in China, J. HERS (*Bul. Soc. Dendrol. France*, No. 45 (1922), pp. 104-109, pls. 4).—Despite the almost complete deforestation of the thickly populated areas of China, individual specimens of various species have been faithfully preserved on account of religious and historical associations. Some of these trees have attained remarkable age and dimensions, e. g., a *Ginkgo biloba* tree in the vicinity of Peking found to be over 26 ft. in circumference. A tabulated list of exceptionally large trees of 34 species is presented, including a specimen of *Thuja orientalis* in Sungshan, Province of Honan, which has a circumference of 10.6 meters (34.8 ft.) and is estimated to be over 20 centuries old.

Production of teak in the intensively managed forest districts on Java, A. J. VAN DEVENTER (*Tectona (Boschbouwk. Tijdschr.)*, 16 (1923), No. 1, pp. 7-39).—As a result of a survey of carefully managed teak forests, the author concludes that the conversion of devastated primeval forests areas into systematically managed and protected districts is a desirable and profitable proposition. Finding transportation facilities to be for the most part inadequate and preventing maximum production, the author emphasizes the urgent need of a definite plan of developing the highways.

[Report of the] division of lands and forests (*N. Y. State Conserv. Comm., Ann. Rpt.*, 12 (1922), pp. 123-186, figs. 25).—This is the usual annual report (*E. S. R.*, 46, p. 843) for the calendar year 1922. Among the subjects discussed are the development of recreational features; fire, insect, and fungi preventive measures; alterations in area; and reforestation activities, which included the establishment of a new forest nursery at Lowville.

The National Park Service, J. CAMERON (*Inst. Govt. Research, Serv. Monog. U. S. Govt. No. 11* (1922), pp. XII+172, pl. 1).—Information is presented relative to the history, activities, and organization of the National Park Service.

Progress report of forest research work in India for the year 1920-21 (*Forest Research Inst., Dehra Dun, Prog. Rpt.*, 1920-21, pp. [3]+84, pls. 8).—Similarly to earlier reports (*E. S. R.*, 44, p. 838), this contains information relative to silvicultural operations and investigations in progress in various

sections of India. A list of forest publications issued since the creation of the Forest Research Institute is appended.

Annual progress report upon State forest administration in South Australia for the year 1921-22, W. GILL (*So. Aust. State Forest Admin. Ann. Rpt.*, 1921-22, pp. 13, pls. 7).—The usual annual report upon the operations of the Woods and Forests Department (E. S. R., 46, p. 541).

Annual report on the forestry department for the year ended December 31, 1921, R. FYFFE (*Uganda Forestry Dept. Ann. Rpt. 1921*, pp. 28).—The usual administrative report (E. S. R., 48, p. 142), to which are appended notes on the forests of Uganda, their size, inaccessibility, composition, and probable value.

DISEASES OF PLANTS.

The origin and structure of plant galls, M. T. COOK (*Science*, 57 (1923), No. 1462, pp. 6-14).—The author, in an address before the botanical section of the American Association for the Advancement of Science, summarized the present state of information relating to the origin, structure, and development of galls on plants.

[Copper in fungicidal sprays], E. F[OEX] (*Jour. Agr. Prat.*, n. ser., 37 (1922), No. 1, pp. 17-19).—This meeting of the Société de Pathologie Végétale was devoted to the consideration of the anticryptogamic properties claimed for copper. An account was given by Villedieu of work leading to views differing widely from those formerly current regarding the toxicity of copper as ordinarily employed against fungus plant diseases. This was discussed. A summary of the views of the Villedieus as understood by Mangin states that copper sulphate may be nontoxic even in concentrations higher than those designated by Millardet, and that any toxic effect of copper salts may be accentuated by their alkalinity or acidity.

Report on the occurrence of insect and fungus pests on plants in England and Wales in the year 1917, T. H. MIDDLETON (*Bd. Agr. and Fisheries [London], Misc. Pub. 21* (1918), pp. 32).—This report, in systematic form, on the occurrence of plant pests and diseases in England and Wales during 1917 was intended as a summary for the use of experts to be filled in as observations should accumulate, looking to an eventual comprehensive account of the subject.

Reports on the occurrence of insect and fungus pests on plants in England and Wales in the years 1918 and 1919, J. C. F. FRYER (*Min. Agr. and Fisheries [London], Misc. Pub. 23* (1920), pp. 65, figs. 21; 33 (1921), pp. 68, figs. 21).—These reports, presented by the chairman of the committee on plant diseases, are somewhat different in form from that noted above. An account of insects in 1918 is followed by one of fungi, with a report on potato diseases by F. T. Brooks and lists of insects and fungi. For 1919 the portion relating to fungi, bacteria, etc., is credited to A. D. Cotton, as were portions of the previous reports.

Report of work done in the mycological section, M. J. NARSIMHAN (*Mysore Dept. Agr. Rpt. 1919-20*, pp. 62, 63).—Coffee black rot was imitated as regards symptoms and microscopic characters by a disease, or two diseases, on two hosts belonging, respectively, to the Rubiaceae and to the Oleaceae. A Thielaviopsis disease of plantain trees suggests sugar cane pineapple disease, as does also a similar disease of areca nut. A Botrytis (*Sclerotinia ricini*) was isolated from diseased castor pods. A rot of turmeric rhizomes proved to be due to *Pythium* sp.

Sandal spike disease was not produced experimentally by growing healthy sandal seedlings in a tub with spike-grafted *Zizyphus*, though *Crotalaria*

plants growing wild near by and serving as hosts to spike-grafted sandal plants showed all the spike symptoms, including starch accumulation. Other observations regarding spike are detailed.

Striga seed did not germinate alone or along with ragi (crowfoot millet) seedlings. A koleroga on wild fig near Marthur suggests that this plant may serve as alternate host to the areca koleroga.

Identification of bacteria pathogenic to plants previously reported from the Philippine Islands, C. G. WELLES (*Philippine Jour. Sci.*, 20 (1922), No. 3, pp. 279-285).—In view of the fact that the study of phyto bacteriology has not yet been pursued to any great extent in the Philippines, most of such diseases reported having been identified by symptoms and not through cultural and morphological studies, the author presents this paper as the first of a series in which all known bacterial organisms pathogenetic to plants in the Philippines are to be briefly described. The present paper is limited to *Bacterium solanacearum*, isolated from wilted tobacco, eggplant, and tomato plants; *Pseudomonas phaseoli*, isolated from bean leaves; *B. malvacearum*, isolated from young, watery lesions on leaves of cotton; and *Bacillus nelliae* n. sp., causing a parsley wilt, for a time believed to be caused by *B. solanacearum*.

Botany [and plant diseases, South Africa] (*Union So. Africa Dept. Agr. Jour.*, 4 (1922), No. 5, pp. 405-407).—Wastage in deciduous export fruits has been made the object of a preliminary study in regard to causes of loss in the shipments.

Alfalfa anthracnose (*Colletotrichum trifolii*) is reported as a serious disease from the Uitenhage District. The seedlings encounter maximum injury during dry weather and when the seed are ripening.

Sclerotium disease of Northern Spy apples is the most serious disease in apple nurseries.

[Plant diseases, South Africa, 1922], G. W. KLERCK (*Union So. Africa Dept. Agr. Jour.*, 5 (1922), No. 1, p. 23).—Regarding the origin of the potato wart disease (*Synchytrium endobioticum*), reported in the paper noted on page 743, only two farms have been found to be infected. The origin of the disease has not been found.

Vegetable and fodder crops noticeably diseased include artichoke rot (an unknown fungus); cowpea rust (*Uromyces appendiculatus*), mildew (*Erysiphe polygoni*?), anthracnose (*Glomerella lindemuthianum*?), and leaf spot (*Ascochyta pisi*), the last three named being new to this host in this region; bean leaf spot (*Cercospora cruenta*); carrot leaf spot (*Alternaria brassicae*?); beet leaf spot (*C. beticola*); and tomato canker (*Bacterium vesicatorium*).

[Crucifer white rust], E. NOFFRAY (*Jour. Agr. Prat.*, n. ser., 37 (1922), No. 2, pp. 40, 41).—Observations carried on during more than 25 years in portions indicated of France are cited as showing that the presence of infected *Capsella* causes large losses to numerous plants mentioned as subject to attack by the crucifer white-rust organism (*Cystopus candidus*).

Wheat ergot, P. DE MONICAULT (*Jour. Agr. Prat.*, n. ser., 38 (1922), No. 34, p. 169).—During the season of 1922 an unusual combination of heat, rain, and cold at the period of maturation caused a loosening of the envelopes around the wheat grain, conditioning a severe infection with ergot in certain portions of France.

The relation of spore load to the percentage of stinking smut appearing in the crop, F. D. HEALD (*Phytopathology*, 11 (1921), No. 7, pp. 269-278).—It is concluded from this study (E. S. R., 48, p. 243) that single smut balls of *Tilletia tritici* contain from 6,000,000 to 9,000,000 spores. The spore load of wheat per grain due to smutting during the threshing operation varied from

0 to 45,416, smut-free wheat being rare except from the drier portions of the State. In experiments at least 0.5 gm. of powdered smut well distributed to each 100 gm. of seed was found necessary to produce maximum smutting. An increase in weight of smut used up to 3 gm. per 100 of seed has in some cases slightly increased the percentage of smut appearing in the crop.

The use of the Levy counting cell alone has given as satisfactory determinations of the spore load as the centrifuge and counting cell combined.

In artificial smutting a spore load of 36,000 to 150,000 has been required to produce the maximum percentage of smut in the crop, the percentage of smut appearing in the crop increasing with the spore load, though less rapidly. The percentage of smut appearing in naturally smutted spring wheat is less than would be indicated by the spore load as based on plantings of artificially smutted samples.

Planting tests of samples of spring wheat with known spore load have made it possible to estimate the amount of smut that will appear in a crop if the seed is planted without disinfection. This does not apply to winter wheat in the Palouse country, where soil contamination is general and variable.

With small spore loads certain spring wheats have remained smut free, others giving a negligible percentage of smut. Probably Marquis will rarely require seed treatment.

The relation of spore load to the percentage of smut appearing in the crop indicates either that a multiple infection occurs, or that there is a chemical mass effect due to numbers of spores.

Wheat stem rust from the standpoint of plant breeding, H. K. HAYES and E. C. STAKMAN (*West. Canad. Soc. Agron. Proc.*, 2 (1921), pp. 22-35, figs. 4).—This paper discusses briefly the methods now being employed in Minnesota in a cooperative attempt by plant breeders and plant pathologists to produce spring wheat resistant to wheat black stem rust (*Puccinia graminis*).

The determination of the number of biologic forms of stem rust is made possible by the use of a series of varieties as host plants. The varieties used in Minnesota represent five species groups, namely, *Triticum vulgare*, *T. compactum*, *T. durum*, *T. dicoccum*, and *T. monococcum*. Five separate types of infection are recognized under greenhouse conditions, slight deviations being noted by signs (plus and minus), as representing inherited differences. Through a correlation of field and greenhouse studies, the meaning of these symbols, from the viewpoint of commercial field resistance, has been rather accurately estimated.

Regarding the three possible causes of the origin of biologic forms, gradual adaptation, mutation, and hybridization, no evidences of the first two have been obtained as the result of numerous and extensive experiments employing both the uredinial and the aecial stages of many biologic forms.

The occurrence of biologic forms furnishes a logical explanation for the conflicting views regarding the stability and adaptability of the wheat rust parasite. Numerous tests of these forms in the uredospore stage have shown that the individual forms are relatively stable. Extensive tests with various biologic forms should be made to determine the possibility of genetic segregation at the time of formation of the teleutospores. Forms which are heterogeneous and give the X type of reaction would appear to be specially favorable material for such study. Disease resistance in plants is inherited in the same way as are other plant characters. Further studies are necessary to determine the number and prevalence of biologic forms of stem rust. These forms can then be used in definite attempts to build up wheat varieties which are resistant to all forms of wheat stem rust.

The production of resistant varieties of crop plants can best be obtained through the cooperation of plant pathologists and plant breeders. Definite cooperation between different research institutions would also aid in solving those problems in which two or more research institutions were interested.

Chocolate spot disease or streak disease of broad beans, S. G. PAINE and M. S. LACEY (*Jour. Min. Agr. [London]*, 29 (1922), No. 2, pp. 175-177, pl. 1).—Broad bean streak disease (*Bacillus lathyri*), though normally doing only a small amount of damage, occurred in 1920 as a serious epidemic, owing to the exceptional weather conditions prevailing during the spring and summer of that year. The organism may have obtained entrance to the leaves by way of the stomata. There is evidence also that the organism is carried by the seed of winter beans, especially those which have been bored by the bean beetle (*Bruchus rufimanus*).

The smuts of millet, H. R. BRITON-JONES (*Egypt Min. Agr., Tech. and Sci. Serv. Bul.* 18 (1922), pp. 6, pls. 3).—A general account of the three millet smuts occurring in Egypt gives also the methods and results of seed disinfection as demonstrated.

Long smut (*Tolyposporium filiferum*) is the most common, occurring in almost every crop of millet, though not so severely as to decrease yield appreciably. The average number of seeds attacked per head varies from 5 to 60, with an average of about 15. The manifestation in any head may be due to a localized attack by a single flower. Disinfection of the seed produced no effect with long smut.

Head smut (*Ustilago reilianae*) is rare, and the loss due thereto is negligible. Bloom infection does not occur. The spores retain germinability and infective capability for about 8 years. Special treatment is necessary for this disease.

Grain smut (*Sphacelotheca sorghi*), though occurring more often than does head smut, causes only a negligible amount of damage at present. Spores retain germinability for at least 6 years.

Treatments, including copper sulphate and formaldehyde, do not impair germinability.

Potato black scab, E. FOEX (*Jour. Agr. Prat., n. ser.*, 38 (1922), Nos. 34, pp. 174-177, pl. 1; 35, pp. 197, 198).—Potato canker (*Synchytrium endobioticum*) is noted as to its occurrence in different countries and its control, including such qualities as varietal resistance to the disease and exceptional earliness or lateness.

The potato scab problem, G. B. SANFORD (*West. Canad. Soc. Agron. Proc.*, 2 (1921), pp. 71-81).—An account of facts bearing upon the potato scab problem, as derived from contributions by others and from observations by the author, is presented in a systematically condensed form.

The potato scab organism multiplies by segmentation of the filaments to form gonidia or fruiting bodies, which persist in all normal soils. No adequate control measures have yet been worked out, though moisture appears to be an important factor and may lend itself to measures leading ultimately to effective control.

Wart disease of potatoes, *Synchytrium endobioticum*, E. M. DOIDGE (*Union So. Africa Dept. Agr. Jour.*, 4 (1922), No. 5, pp. 447-451, figs. 3).—Despite regulations existing since 1912, potato wart disease (*S. endobioticum*) has appeared in at least one locality in the Impendhle Division, Natal, and an investigation has been started to ascertain the extent of the infection, with a view to preventing its spreading.

Facts known regarding the appearance of wart disease at other places are recorded, emphasizing the fact that the resting sporangia in the soil are known to retain the power of infection for at least nine years.

Tobacco wildfire in Wisconsin, J. JOHNSON and S. B. FRACKER (*Wisconsin Sta. Bul.* 348 (1922), pp. 21, figs. 11).—A popular description is given of the disease of tobacco known as wildfire, which is due to *Bacterium tabacum*. This disease is said to be distributed quite largely through storms injuring the tobacco and supplying moisture necessary for the development of the bacteria.

For the control of this disease, the prevention of seed-bed infection and the removal of diseased plants from the field are recommended.

Plant diseases in the Western Province, V. V. A. PUTTERILL (*Union So. Africa Dept. Agr. Jour.*, 4 (1922), No. 5, pp. 430, 431, figs. 2).—Experimentation with pear scab (*Fusicladium* sp.) treatments indicated the necessity for spraying the trees four or five times during the season with Bordeaux mixture or lime sulphur. This should be done when the buds are opening, when the blossom buds have opened, when the last petals are falling, two weeks thereafter, and about five weeks later. In September, 1921, the winter stage of this fungus was discovered for the first time in South Africa.

Note on the Fusarium wilt disease of bananas, M. A. CARLETON (*Science*, 56 (1922), No. 1458, pp. 663, 664).—A brief report is given of experiments which are said to confirm the conclusions of Brandes regarding the Panama disease of bananas (*E. S. R.*, 43, p. 848).

In the experiments described large cement pots were filled with soil, and a portion of them was sterilized by steam for two hours. On November 1 the banana plants were set in the pots, and in the case of seven of the pots the material was inoculated with laboratory cultures of *Fusarium cubense* before planting. In February, one of the inoculated plants showed signs of disease, and by April 1 every plant of the inoculated series was diseased. On July 12 none of the plants in the inoculated pots, either sterilized or unsterilized, gave any indication of disease. The variety of banana used in this experiment was Gros Michel.

Brown rot of citrus fruit, G. SAMUEL (*Jour. Dept. Agr. So. Aust.*, 26 (1922), No. 2, pp. 112-118, figs. 5).—The only disease which has so far proved of importance in causing citrus fruit rots is the common blue mold (*Penicillium* sp.). The account here given of the life history of the fungus would indicate that this is unlikely to become very important in South Australia, and it is considered possible that the fungus may be eradicated from the ground entirely in a given area by proper cultivation during a hot Australian summer.

Pressures required to cause stomatal infections with the citrus-canker organism, F. T. McLEAN and H. A. LEE (*Philippine Jour. Sci.*, 20 (1922), No. 3 pp. 309-321, figs. 2).—Among the species of Citrus resistant to canker are the mandarin orange varieties, which in orchards showing heaviest infection in Japan, China, and the Philippines remain almost entirely free from the disease. It was shown by both authors together in an article previously noted (*E. S. R.*, 48, p. 248) that resistance to canker in the mandarin orange is due to some character of the epidermis, and by McLean (*E. S. R.*, 47, p. 546) that the stomata of the resistant mandarin orange differ markedly, as regards structure, from the very susceptible grapefruit, these differences being associated with greater permeability to water in the leaves of the grapefruit. By use of comparatively slight pressure, water could be forced through the uninjured stomata of the grapefruit.

These results suggested strongly that structural stomatal differences determine susceptibility or resistance to canker, and in the study here reported a method was devised and tested for drawing water into intact leaves on the orchard trees by the use of known and easily measurable pressure, the device used being an adaptation of the porometer used by McLean in work previously noted (*E. S. R.*, 46, p. 432). Canker has been produced in young leaves of

the mandarin orange, grapefruit, and pomelo by substituting an infusion of *Pseudomonas citri* for the water. These experiments are described.

Leaves of Szinkom mandarin orange, Washington navel orange, seedling East Indian pomelo, and Pernambuco grapefruit were tested by this method to determine their comparative injection pressure with water. Tests with citrus leaves showed the average pressure for Pernambuco grapefruit to be 19.5 cm. of mercury; seedling East Indian pomelo, 19.6; Washington navel orange, 20.8; and Szinkom mandarin orange, 33.6 cm. The average injection pressures of the above 4 varieties are directly proportional to their canker resistance, as shown by field observations.

Leaves of the resistant Szinkom mandarin orange, and of seedling grapefruit and pomelo trees, both very susceptible, were tested for their resistance to the entrance of canker organisms applied in water under pressure. Szinkom (mandarin orange) leaves were resistant to canker infection by immersion, and up to pressures of 10 cm. of the mercury column. With high pressures numerous cankers developed in leaves of this variety. Grapefruit and pomelo leaves developed canker readily by immersion without added pressure. The pressures necessary to cause canker infection thus agreed with the degree of observed field resistance of the varieties tested.

The results obtained substantiate the theory previously advanced that structural differences in the stomata constitute one cause for the differences in susceptibility of the mandarin orange and the grapefruit and pomelo varieties. In the mandarin orange the structure of the stomata apparently prevents the ingress of surface water; in the grapefruit the stomatal structure is such as to allow the ingress of surface water, which thus affords a medium of entrance for the canker bacteria. The results are held to indicate definitely that the resistance of the mandarin orange to disease is due to mechanical structural differences.

Relation of the age of citrus tissues to the susceptibility to citrus canker. H. A. LEE (*Philippine Jour. Sci.*, 20 (1922), No. 3, pp. 331-341, pls. 4, fig. 1).—In this paper experimental results are presented as confirmatory of conclusions previously offered (E. S. R., 48, p. 247) to the effect that advance toward maturity increases resistance to canker in citrus trees.

Preliminary experiments were begun on fruits of the pineapple orange (*Citrus sinensis*) inoculated with the canker organism (*Pseudomonas citri*), and it was found that a rather high susceptibility in fruits of small diameter gave way to a lowered susceptibility as growth proceeded until in large fruits approaching maturity but slight effect, if any, was produced. The same was found to be true of the Valencia orange.

Experiments carried to the end of the growing season with the Washington navel orange inoculated in late May and early June, and at different periods thereafter, gave still more definite and striking results. Parallel tests on the Ikiriki strain of the Unshiu (Satsuma) orange (*C. nobilis unshiu*) showed that the period of susceptibility is 98 days for that variety, that of the Washington navel orange being 120 days. Further systematic data point to a still longer period of susceptibility for the grapefruit. Data on increase of resistance in leaves are difficult to obtain, owing to the difficulty in obtaining criteria as to the maturity of a leaf. However, the experimental results with leaves showed that, as the leaves become fully developed in size, the amounts of infection obtained, both with needle punctures and as stomatal infections, are very much lessened. Leaves become entirely resistant when they reach full size at maturity. The results from the experiments described are considered to warrant the statement that the susceptibility of fruit and foliage tissues decreases with their advance toward maturity.

Citrus canker eradication (*Union So. Africa Dept. Agr. Jour.*, 4 (1922), No. 5, p. 477).—Farms inspected for citrus canker in the districts of Pretoria, Rustenburg, and Waterberg show neither fresh outbreaks nor fresh infection.

A new citrus disease, C. F. COLE (*Jour. Dept. Agr. Victoria*, 19 (1921), No. 6, pp. 363-366).—The author's opinion, based on observations of heavy damage by *Pythiacystis citrophthora* in a small citrus grove at Lower Everton (where this new disease was first noted in Victoria), is that this trouble is as much to be feared as any previously known in this region.

Like *Phytophthora infestans*, this disease appears suddenly, the first signs following cold, wet weather in June or earlier. After this the attacks are periodical, the severest occurring at Everton in August and early September. The greatest damage to the fruit is done by the late attacks, though foliage and twigs may suffer severely earlier. Recurrence of attacks on any tree depends largely upon the amount of foliage remaining.

Citrus fruits known to be subject to attack include oranges, grapefruit, kumquats, and mandarins, lemons thus far appearing immune.

Burgundy mixture appears to retard the spread of this disease. Bordeaux mixture is also suitable. Judicious pruning is recommended, especially removal of low branches, with treatment of pruning wounds.

A little-known disease of Iris, C. COLIZZA (*Sta.: Sper. Agr. Ital.*, 53 (1920), No. 12, pp. 494-504, pl. 1, figs. 2; *abs. in Internatl. Inst. Agr. [Rome]*, *Internatl. Rev. Sci. and Pract. Agr.*, 12 (1921), No. 4, pp. 508, 509).—*Iris florentina* and *I. germanica* in Lazio are attacked by *Septoria indis*, causing a leaf dry spot which is discussed as to microscopic observations, comparative anatomy, systematic relationships of the causal fungus, predisposing factors, and control measures, including copper and iron salt solutions.

Disease resistance in the American chestnut, A. H. GRAVES (*North. Nut Growers Assoc. Proc.*, 10 (1919), pp. 60-67, pls. 4). Systematic search for chestnuts resistant or immune to the *Endothia* blight, begun in 1918 and carried out within a radius of about 16 miles from the New York City Hall, showed no immune trees. The older trees were mostly dead and weathered, while seedlings and saplings were noted as being either diseased or healthy, according (apparently) to whether they had or had not received bark injury and inoculation thereat. The most important result was the finding of three well-defined colonies of living mature trees which are offering more or less resistance.

The supposedly characteristic features observed in the resistant trees are enumerated, with discussion. One of these is a tendency of the cortex to callus and heal or to give way slowly to the fungus, whose rates of spread may in such cases be very gradual. In no case was resistance absolute, through degrees were observed. A callus forms and tends to thicken and spread beyond the immediate neighborhood of the canker, some cases appearing in which, though no canker appeared externally, the whole inner bark was callused, the outer bark sloughing off so as to give a characteristic gray, weathered appearance to such trees.

The most striking peculiarity of the callus tissue is its abundant content of a thickish, milky, white substance. This is not evenly distributed through the irregular grain of the wound tissue, but is particularly abundant in small spots or pockets which are conspicuous in the callused margin of the lesion. Soon after exposure to the air, the cut bark and particularly the white substance redden with exceptional rapidity, indicating supposedly a high rate of oxidation. No chemical analysis has yet been made of this substance, but evidence at hand warrants a tentative statement that it is very rich in tannin

or tannin compounds, and that possibly the quality of resistance is bound up with the nature of this material.

Inoculation tests on the resistant trees gave cankers which grew about one-third or one-fourth as fast on the average as on nonresistant stock.

The author believes that further work will prove the resistance to be heritable. It is not due to a particularly favorable environment of the trees, for the three groups grow in very different soils and under varying conditions of light and moisture. The finding of the trees in colonies points to a genetic variation. In a considerable number of cases all of the members of the same group of coppice trunks from an old stump show a similar degree of resistance.

Diseases of the French chestnut tree, particularly the "ink malady," E. SCHELL (*Jour. Amer. Leather Chem. Assoc.*, 17 (1922), No. 7, pp. 353-359).—A summation is given of information obtained regarding diseases of the chestnut, particularly the ink malady or disease, of which the outbreak and progress are described as noted in Europe and as due supposedly to the fungus regarded by Mangin as a new species and by him named *Mycelophagus castaneae* (E. S. R., 15, p. 165). This fungus is supposed to be an oomycete, though its organs of fructification have not been identified with certainty. Its anaerobic character is attested by the fact that the last chestnut trees to yield to the disease are those on the edge of terraces where the roots are partly aerated.

Treatment is difficult and uncertain. Hybridization for resistance and grafting on resistant stocks are indicated as offering a possibility of obtaining resistant stock bearing desirable chestnuts.

Observations on the infection of Crataegus by Gymnosporangium, J. F. ADAMS (*Mycologia*, 13 (1921), No. 1, pp. 45-49, figs. 4).—A close association of red cedar (*Juniperus virginiana*) and hawthorns (*Crataegus* spp.) growing on the slopes of Tussey Mountain at Mussers Gap, Center Co., Pa., is described as to infection of these hosts and of *Malus glaucescens* by *Gymnosporangium*.

Chlamydospores of Fomes officinalis in nature, W. H. SNELL (*Phytopathology*, 11 (1921), No. 4, pp. 173-177, figs. 2).—The author, in 1918, found chlamydospores of *F. officinalis* in connection with a heavy growth of mycelium of this fungus appearing on Douglas fir, which was badly decayed thereby. The chlamydospores germinated readily on malt agar, though in case of chlamydospores of this fungus on wood of *Pinus ponderosa* sent from Massack, Plumas Co., Calif., no germination was obtained, possibly on account of age and prolonged drying of the material.

Studies on plant cancers.—II, The behavior of crown gall on the rubber plant (Ficus elastica), M. LEVINE (*Mycologia*, 13 (1921), No. 1, pp. 1-11, pls. 2).—The purpose of this paper, in pursuance of a previous report (E. S. R., 43, p. 242), is to bring forward evidence regarding the malignancy of the crown gall experimentally induced in mature evergreen perennials, such as the rubber tree (*F. elastica*). Brief discussion is given of a number of cases as compared with those reported by others.

It is shown that *Bacterium tumefaciens* inoculated into the branch apical internode, the leaves, or the main stem of the rubber tree (*F. elastica*) stimulates the development of a neoplasm in the region of inoculation of a benign or malignant nature. The crown galls so formed in this plant are of two kinds, one in which growth is uniform and appears to be a swelling, the other showing the characteristic convoluted type which indicates a peripheral growth of isolated nodules.

Crown gall in the early stages of development in *F. elastica* does not interfere with the life of the plant as a whole, nor does it interfere with the growth when inoculated on branches. After some months of active growth it becomes hard and dry and finally dies. This is associated with a differentiation of the

tissue which converts the gall into a mass of parenchymatous cells of nodules of woody fibers. The central portion of the crown gall which generally lies near the woody cylinder disintegrates. The invasion of the stem by the new growth does not destroy the entire conducting system of the stem, yet that portion of the stem above the gall dies as well as a considerable portion of the stem below.

Cultures made from pieces of the crown gall and the stem above it yield only a schizomycete, which in appearance is somewhat like *B. tumefaciens* and which when inoculated into the stem of young geranium and rubber plants produces crown galls in the region of inoculation. It is regarded as possible that the crown gall cells or the crown gall-forming organisms are responsible for the progressive necrosis of the stem from the gall upward and downward.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Reindeer and musk ox: Report of the Royal Commission upon the possibilities of the reindeer and musk-ox industries in the Arctic and sub-Arctic regions, J. G. RUTHERFORD ET AL. (*Ottawa: Dept. Int., 1922, pp. 99, figs. 31*).—This report recommends, among other things, that small experimental reindeer herds be established in a number of such localities as may, after searching departmental investigation, be found most desirable in points of vegetation and otherwise. It includes appendixes which deal, respectively, with the subject as follows: Review of the Alaskan Reindeer Service of the U. S. Department of the Interior as Compiled from the Official Reports of the United States Government (pp. 41-51); Musk Ox, by W. T. Hornaday (pp. 52-54); Reindeer and Musk Ox, Hudson Bay Region, by H. T. Munn (pp. 55-59); Dr. Grenfell's Reindeer Experiment in Labrador (pp. 60, 61); Report of C. C. Parker, Inspector of Indian Affairs for Ontario and Quebec, to the Deputy Superintendent General of Indian Affairs, on the Herd of Reindeer Taken Over from Dr. Grenfell and Maintained at Lobster Bay, on the Gulf of St. Lawrence (pp. 62-65); Summary of Report of Experiment in Connection with the Introduction of Reindeer into the Northwest Territories by the Department of the Interior in 1911 (Location of Herd at Fort Smith on the Slave River) (pp. 66, 67); Submission of the Rev. W. G. Walton, Missionary, Church of England, Stationed at Fort George on James' Bay, Ungava (pp. 68-70); Memorandum on Barren Land Caribou and Musk Ox, by R. M. Anderson (pp. 71-76); Reindeer in Siberia, by J. Muir (pp. 71-81); Lapp Immigration to Northern Canada and Lapps as Herders of Reindeer, by Harkin et al. (pp. 82, 83); Lapps and Reindeer in Sweden and Norway, by J. Lundbohm (pp. 84-88); Reindeer in Northern Europe, by A. Allanach (pp. 89-91); and Reindeer in Siberia, by B. P. Bertholf (pp. 92-96).

Annual report of the Governor of Alaska on the Alaska game law, 1922, S. C. BONE (*U. S. Dept. Agr., Dept. Circ. 260 (1923), pp. 7*).—This is the annual report (E. S. R., 47, p. 549) on the administration of the Alaska game law for the fiscal year ended June 30, 1922. It includes data on the status of game animals, nonmigratory and migratory birds, and fur-bearing animals. Data relating to hunting licenses, special moose shipping and general game shipping licenses, and game or trophies shipped from Alaska are presented in tabular form in an appendix.

Birds in flight, W. P. PYCRAFT (*London: Guy & Hancock, Ltd., 1922, pp. X+133, pls. 20, figs. 20*).—This work deals with the subject as follows: Concerning wings (pp. 1-13), the first bird (pp. 15-19), the sizes and shapes of wings and their relation to flight (pp. 21-33), modes of flight (pp. 35-51), courtship flights (pp. 53-69), how to tell birds on the wing (pp. 71-115).

the wings of nestling birds (pp. 117-125), and flightless birds (pp. 127-133). The work is illustrated by 12 colored plates.

The reciprocal relation of soil and insects, J. W. MCCOLLOCH and W. P. HAYES (*Ecology*, 3 (1922), No. 4, pp. 288-301).—This is a preliminary consideration of studies of the relations of insects and soil conducted at the Kansas Experiment Station.

Pests of the garden and orchard, farm, and forest, R. PALMER and W. P. WESTELL (London: Henry J. Drane, 1922, pp. 413, pls. 47).—The first part of this work (pp. 17-168) deals with injurious and beneficial insects, part 2 (pp. 169-229) with animals other than insects, part 3 (pp. 231-289) with fungus diseases, part 4 (pp. 291-310) with noxious weeds, and part 5 (pp. 311-348) with insecticides and fungicides. Part 6 (pp. 349-364) consists of Miscellaneous Information and useful tables, and part 7 (pp. 365-393) of identification and spraying tables. The work includes a glossary of scientific terms used (pp. 394-398), references to the authorities consulted (p. 399), an index of scientific names (pp. 400-403), and a subject index (pp. 404-412).

Insect pests of various minor crops and fruit trees in Mauritius, I. D'EMMERZ DE CHARMOY and S. GÉBERT (*Mauritius Dept. Agr., Sci. Ser. Bul.* 8 (1921), *English ed.*, pp. 20).—This is a report of a preliminary study of the insects attacking some 25 minor crops and fruit trees in Mauritius. Notes on Insects Accidentally Introduced into the Island of Mauritius, by the senior author (pp. 15-18), and a list of the plants dealt with and the pests attacking them are appended.

The occurrence of injurious forest insects in Sweden in 1918, I. TRAGÅRDH (*Meddel. Statens Skogsforsökanst.*, No. 18 (1921), pp. 281-314, figs. 15).—This is a summary of information on the more important insect enemies of the forests in Sweden in 1918.

Report on available supply of arsenic to supply the demand in 1923, B. R. COAD and G. F. LOUGHLIN (*U. S. Senate, 67. Cong., 4. Sess., Doc.* 290 (1923), pp. 11).—This is a joint report prepared in response to a Senate resolution authorizing and directing the U. S. D. A. Bureau of Entomology and the U. S. Geological Survey to investigate the available supplies of arsenic in the United States. A conference of representatives of producers of white arsenic and manufacturers of arsenic compounds and the authors was held in December, 1922, and ways and means of stabilizing the market were referred by the conference to a committee consisting of the authors, representing these two branches of the Government, and representatives of six producers and manufacturers.

Metallic mercury as an insecticide, A. O. LARSON (*Jour. Econ. Ent.*, 15 (1922), No. 6, pp. 391-395).—In experiments in which black-eyed cowpeas infested with *Bruchus quadrimaculatus* were exposed to mercury, the eggs and larvae failed to develop. The author suggests that this may prove to be a method for controlling the clothes moth. This action of metallic mercury was called to the author's attention by Kunhi Kannan of India, an account by whom has been noted (*E. S. R.*, 45, p. 657).

Nicotin delivery from dust carriers, W. RUDOLFS (*Jour. Econ. Ent.*, 15 (1922), No. 6, pp. 421-424).—The author's studies have led to these conclusions:

"Nicotin derived from nicotin sulphate (1) is evolved less rapidly from a colloidal than from a crystalloidal carrier, (2) is evolved most readily when a large percentage of carbonates (Ca and Mg) is present, and (3) is evolved more readily under influence of high temperature and high atmospheric moisture conditions. Nicotin derived from high strength (95 per cent) 'free' nicotin solution (1) is evolved more readily from a crystalloidal than from a colloidal carrier, (2) is evolved from dolomite, hydrated lime, etc., at approxi-

mately the same rate, (3) is evolved more rapidly under high temperature and low atmospheric conditions, and (4) is evolved much more rapidly under high temperature and low atmospheric conditions than from nicotin in the sulphate form."

The nicotin content of tobacco smoke, J. P. BAUMBERGER (*Jour. Pharmacol. and Expt. Ther.*, 21 (1923), No. 1, pp. 35-46, fig. 1).—"The nicotin content of tobacco smoke can be determined by Chapin's method, with the modifications of Rasmussen, without pyridin interference. The average nicotin content of the smoke in percentage weight of tobacco is 0.573 per cent for cigarettes. Of the nicotin in the tobacco about 14 to 33 per cent appears in the smoke puffed."

Facts concerning natural breeding area of beet leafhopper (*Eutettix tenella* Bak.) in San Joaquin Valley of California, H. H. P. SEVERIN and A. J. BASINGER (*Jour. Econ. Ent.*, 15 (1922), No. 6, pp. 411-420).—The authors first consider the favorable breeding plants of beet leafhoppers in cultivated areas and then those on the plains and foothills, following this by an account of the favorable habitat of the beet leafhopper.

Facts concerning migration of beet leafhopper (*Eutettix tenella* Bak.) in Sacramento Valley of California, H. H. P. SEVERIN and A. J. BASINGER (*Jour. Econ. Ent.*, 15 (1922), No. 6, pp. 404-411).—This account is presented under the headings of curly leaf, average tons per acre in the Sacramento and San Joaquin Valleys, spring migration, autumn and winter investigations, favorable breeding plants of beet leafhopper in the cultivated area, climate, and barriers.

A fungus parasite of the imported apple sucker (*Psyllia mali* Sch.): Artificial spread of *Entomophthora sphaerosperma*, A. G. DUSTAN (*Agr. Gaz. Canada*, 10 (1923), No. 1, pp. 16-19).—Investigations in Nova Scotia of natural control commenced in the spring of 1921 and continued for two summers have clearly shown that the fungus disease caused by *E. sphaerosperma* is the chief factor instrumental in bringing about a natural decrease in the numbers of the apple sucker, which now occurs in five counties in the Province. The artificial spread of this fungus resulted in the extermination of the pest over a 5-mile area in the most heavily infested section.

Resistance of certain scale insects in certain localities to hydrocyanic acid fumigation, H. J. QUAYLE (*Jour. Econ. Ent.*, 15 (1922), No. 6, pp. 400-404).—The author finds that there are two localities in California where it seems well established that the citrus red scale (*Chrysomphalus aurantii* Mask) is very resistant to hydrocyanic acid gas, and one locality where the black scale is specially resistant. In these localities the two scales are not immune to hydrocyanic acid, but the dose required for satisfactory results is so great that effective fumigation is unsafe for the tree except under the most favorable conditions.

On the dispersion of the pink bollworm in Egypt, L. H. GOUGH (*Egypt Min. Agr., Tech. and Sci. Serv. Bul.* 24 (1922), pp. [2]+21).—This is a report of an attempt made to determine the mode of distribution of the worms in the bolls. The investigations, much of the data relating to which are presented in tabular form, have led to the following conclusions:

"The distribution of pink bollworm attack in cotton bolls follows definite rules in Sakellarides cotton. For any given percentage attack it is possible to calculate the numbers of bolls per 100 with 0, 1, 2, 3, 4, and more worms. The damage is directly proportionate to the number of worms which have attacked the bolls. The damage done by a single worm is about one-tenth of the yield of the boll in Sakellarides cotton. When the percentage attack is known, it is possible to predict the number of bolls per 100 attacked in 0, 1, 2, or 3 locks, whereby there is evidence that about 1 worm in 4 does damage to more

than 1 lock in Sakellarides cotton. It is obvious from the study of the facts brought forward that it is not permissible to make averages of percentage attacks of bolls. If averages are required they must be made after converting the figures for percentage attack into numbers of worms per 100 bolls or into percentage damage done."

Peach twig-borer experiments in California, W. P. DURUZ (*Jour. Econ. Ent.*, 15 (1922), No. 6, pp. 395-400, pl. 1).—This is a preliminary report giving the details of experiments with the peach twig-moth, which has again become a very serious pest in California. While the results of two years' investigations are not conclusive enough to warrant definite recommendations, much valuable information has been obtained.

It appears that lime sulphur alone can not be regarded as a satisfactory remedy. "The addition of arsenate of lead (neutral or basic) or nicotin sulphate to lime sulphur and this mixture applied as near the pink stage as possible is considered to be the best control for the peach twig-borer at the present time. If lime sulphur spraying is not necessary for fungus diseases, nicotin sulphate sprayed at blooming time is recommended. On account of the fact that there is a second generation, one spraying may not be sufficient. If complete control is not secured in a given district, the flight of surviving moths may scatter and multiply the infestation, and 'wormy fruit' will be the result. A spray applied the middle of May will probably reduce the fruit damage."

The author is now testing the effectiveness of nicotin sulphate and lead arsenate against the second generation of larvae.

The apple and plum case bearer (*Colcophora nigricella* Stgch.) and its treatment, F. V. THEOBALD (*Jour. Pomol. and Hort. Sci.*, 3 (1922), No. 1, pp. 47-53, figs. 7).—This is an account of a tineid moth, the larvae of which became of economic importance in East Sussex, Kent, and South Devon in 1918 and 1919. The pest is quite similar to the cigar case-bearer, which is an important pest in the United States. Experiments conducted in England in 1920 and 1921 show that it can be quite well controlled in the case-bearing stages in spring, as was found by Slingerland with the cigar case-bearer (*E. S. R.*, 7, p. 227).

Dengue fever in Louisiana, L. C. SCOTT (*Jour. Amer. Med. Assoc.*, 80 (1923), No. 6, pp. 387-393).—This is a report of observations made during the epidemic of dengue fever that prevailed in Louisiana from the early part of September until the latter part of December, 1922. The author concludes that the yellow fever mosquito (*Aedes aegypti*) was the principal if not the sole vector of the disease.

Notes on the limit of the usefulness of fish in larvae (*Aedes calopus*) control, W. M. MONROE (*Amer. Jour. Trop. Med.*, 3 (1923), No. 1, pp. 21-26).—"An average larvae consumption for the class of fish generally used is about 150 per day. Bottom feeding fish are rather more efficient for their weight than top feeders. When breeding is found in barrels in which there are fish it is not because of the refusal of the fish to eat, but because of the presence of a number of larvae beyond the limit of its possibilities to consume."

The warble flies of cattle: *Hypoderma bovis* and *H. lineatum*, C. WARBURTON (*Parasitology*, 14 (1922), No. 3-4, pp. 322-341, figs. 3).—This includes a summary of the present status of knowledge of the bionomics of the two species, their injuries to cattle, and differentiation. A list of 44 references to the subject is included.

Is the house fly in its natural environment attracted to carbon dioxide? C. H. and E. H. RICHARDSON (*Jour. Econ. Ent.*, 15 (1922), No. 6, pp. 425-430).—The author's investigations have led to the following conclusions:

"Bran which volatilizes carbon dioxid alone when exposed in the natural environment of the house fly will not induce oviposition. Bran which volatilizes the products of decomposition of ammonium carbonate in aqueous solution attracts the house fly and induces egg laying. Since carbon dioxid and water, two of the final decomposition products of ammonium carbonate, do not in themselves induce egg laying, it is believed that ammonia is largely responsible for the attraction to ammonium carbonate. The possibility of other substances exerting an augmenting influence on the attraction to ammonia is admitted, but no definite proof of it was indicated in these experiments. Some preliminary experiments with ammonium hydroxid solutions were only partially successful in calling forth the oviposition response. Some possible reasons for this are mentioned."

Fruit fly investigations, H. JARVIS (*Queensland Agr. Jour.*, 19 (1923), No. 1, pp. 1-4).—This is a progress report of investigations of the Queensland fruit fly (*Chactodacus tryoni*).

The sugar-beet root-maggot (*Tetanops aldrichi* Hendel), a new pest of sugar beets, I. M. HAWLEY (*Jour. Econ. Ent.*, 15 (1922), No. 6, pp. 388-391).—This is an account of an apparently native species which has fed on weeds for many years and is now attacking sugar beets in Utah. It has been reported as causing considerable damage locally in Idaho and Colorado. With the exception of a possible infestation in Emery County, the destructive work in Utah seems to be restricted to a few townships in Cache County.

The cabbage maggot, with special reference to its control, G. W. HERRICK and W. COLMAN (*New York Cornell Sta. Bul.* 413 (1922), pp. 15, figs. 9).—Following an account of the life history and binomics of the cabbage maggot, the authors record the results of work with corrosive sublimate as a means of control conducted during the seasons of 1921 and 1922, the details of which are presented largely in tabular form. They find that this pest can be controlled satisfactorily by the application of corrosive sublimate in solution with water at dilutions of 1 oz. to 8 gal. and 1 oz. to 10 gal.

"Radishes may be protected from injury by the maggot with two or three applications of the poison at a strength of 1 oz. to 8 gal. in the case of average infestations, or with an application each week during the growing period of the plants at a strength of 1 oz. to 10 gal. Slight burning and whitening of the leaves may result if the solution is poured directly over the plants. It is wiser to direct the stream below the leaves and against the stems as much as possible.

"Early cabbages in the field may be protected from injury by treatments at intervals of about one week, the first application being made within three or four days after the plants have been set in the field. There seems to be little difference between the effectiveness of a strength of 1 oz. to 8 gal. and one of 1 oz. to 10 gal. Since, however, there is so little difference in the cost of the two strengths, the former is recommended, especially where the infestation has been severe. At least two applications should be made, and three would give greater insurance of protection from injury.

"Evidence has been obtained which shows that late cabbage plants in the seed bed may be protected from the maggot by weekly applications of corrosive sublimate during the growing period of the plants. The data obtained, however, are not sufficient to serve as a basis for definite recommendations."

A new tachinid parasite of the codling moth (Dip.), J. M. ALDRICH (*Ent. News*, 34 (1923), No. 2, pp. 53, 54).—Under the name *Anachactopsis vagans* the author describes a new tachinid which was reared from the codling moth at Medford, Oreg.

Cane pest combat and control, E. JARVIS (*Queensland Agr. Jour.*, 18 (1922), No. 6, pp. 392-394).—The author here includes a report of further investigations of the effect of paradichlorobenzene on cane and cane grubs (E. S. R., 48, p. 58).

In a crucial test a number of tins of soil, about 3.5 in. square by 5 in. deep, were treated with 0.5 oz. injections placed immediately below small sets 2 in. long, each having a single bud. The gas confined in this way was found to have an injurious effect, owing, it is thought, to the fumes having entered the cut ends of the sets. The eyes in some of the tins produced plants about 3 in. in height, which then stopped growing owing to nondevelopment of the roots. However, a cowpea seed that had not received any mechanical injury germinated in one of the treated pots, producing a small plant which at the time of writing appeared to be developing in a normal manner.

Notes on the coconut beetle (*Oryctes monoceros* Ol.) in Kenya Colony, F. W. DRY (*Bul. Ent. Research*, 13 (1922), No. 1, pp. 103-107).—This is a report of observations on the life history of *O. monoceros* made on the coast of Kenya Colony from August, 1920, to February, 1921, together with field observations.

Control of the apple blossom weevil, H. W. MILES (*Jour. Pomol. and Hort. Sci.*, 3 (1922), No. 1, pp. 54-61).—A brief account of the life history of *Anthonomus pomorum* L. is followed by the details of work with preventive and control measures.

The ability of queen and drone honeybees to feed themselves, E. F. PHILLIPS (*Jour. Econ. Ent.*, 15 (1922), No. 6, pp. 430-432).—This is a brief report of observations by the author.

Some bionomics of *Alphelinus semiflavus* How., chalcid parasite of aphids, E. A. HARTLEY (*Ohio Jour. Sci.*, 22 (1922), No. 8, pp. 209-239, figs. 10).—This is a report of studies of the life history and bionomics of one of the few species of the genus *Alphelinus* known to attack aphids, the others being scale parasites. In addition to the previously known hosts, namely, the green peach aphid, the cotton aphid, *Aphis maidis* Fitch, and *Charophorus viminalis* Mon., the author adds *Macrosiphum psi* Kalt., *M. granarium* Kby, *M. sanborni* Gill, rarely, and *Anuraphis viburnicola* Gill., from which he has reared the parasite. "*Myzus persicae*, from which most of the field records come, seems to be the preferred host, although it took to *M. granarium* and *A. viburnicola* quite as readily in captivity. *M. psi* was not parasitized very heavily, due, perhaps, to its long legs and large size and irritability. *M. sanborni* escaped almost entirely, for no apparent reason."

A list is given of 20 references to the literature.

On the chalcidoid parasites of psyllids (Hemiptera, Homoptera), J. WATERSTON (*Bul. Ent. Research*, 13 (1922), No. 1, pp. 41-58, figs. 7).—This is a summary of information on the chalcidids reared from psyllids.

FOODS—HUMAN NUTRITION.

Report of the Food Investigation Board for the year 1921, W. B. HARDY ET AL. ([*Gt. Brit.*] *Dept. Sci. and Indus. Research, Food Invest. Bd. Rpt. 1921*, pp. II+47, pls. 4).—This annual report of the Food Investigation Board of Great Britain includes an introductory section in which, in addition to a brief summary of the work of the various committees, a description is given of a low temperature station for research in biochemistry and biophysics at Cambridge. This section is followed by the annual reports of the various committees, including the fish preservation, meat, engineering, fruit and vegetables, oils and fats, and canned foods committees. Much of the work outlined in these reports has been noted from other sources.

The bacteriology of canned meat and fish, W. G. SAVAGE, R. F. HUNWICKE, and R. B. CALDER ([*Gt. Brit.*] *Dept. Sci. and Indus. Research, Food Invest. Bd., Spec. Rpt. 11* (1922), pp. III+72).—This report is based on the examination of 116 samples of canned meat and 207 of marine products. The larger number of samples were from tins rejected owing to some abnormality when inspected by the methods noted in a previous report (*E. S. R.*, 44, p. 360). The rest were from ordinary tins as purchased. The usual precautions were taken to obtain the samples aseptically, and the ordinary culture media necessary for the classification and identification of the bacteria isolated were employed. While the publication should be consulted in the original for the detailed findings, certain points of general interest, as emphasized by the authors, are as follows:

Of the 76 samples, the contents of which were perfectly sound, 47 were found to be bacterially nonsterile. The types of organisms found in these samples were obligate anaerobes 2, sporing aerobes 23, thermophils 24, micrococci 13, and nonfermenting, nonsporing organisms 2. These findings are thought to indicate that sterility in itself is not a reliable test of soundness and that samples can not be justifiably condemned merely because they are not sterile, and also to suggest that unsoundness in canned food is not necessarily due to outside contamination, but because conditions within the can have become changed in such a way as to enable bacteria already present to multiply and decompose the food.

As to the general relationship of different types of bacteria to the soundness of the food, as indicated by the types of organisms found in the spoiled samples, yeasts were not found at all in fish samples and only once in meat. Molds were found in only 1 of the fish samples but in 7 of the meat samples. Evidence of leakage was present in all these cases. Obligate anaerobes were found in 9 meat and 18 marine products. Of the strains which could be identified 7 were identical with or closely allied to *Bacillus sporogenes* and 12 were of the *B. rauschbrand* type. Most of these were associated with putrefaction, although 2 were found in perfectly sound samples. Spore-forming aerobic organisms were widely distributed in sound and decomposed products alike. No strains corresponding to any known pathogenic types were isolated from any of the samples. Many were, however, of the proteolytic type capable of decomposing the food in case of leakage and access of air. A considerable number were also found capable of multiplying under stringent anaerobic conditions. The thermophilic organisms were practically all nonproteolytic and, therefore, can not be considered as possible causes of spoilage. The nonsporing organisms were of various types, including those capable of fermenting carbohydrates with gas production and causing proteolysis. The micrococci were nonpathogenic and probably not responsible for spoilage.

In discussing the conditions under which canned goods become unsound, it is concluded that the extent to which food becomes unsound depends upon several factors including the extent and type of the bacterial contamination, the efficiency of the processing, the access of air to the tins, and the temperature environment of the samples.

"To sum up this section, manufacturers who wish to ensure the absence, or at least a minimum, of spoilage must be encouraged to obtain their food products as fresh as practicable, to can them as speedily as possible under conditions of great cleanliness, to treat their products so as to ensure the presence of a vacuum, to employ the right 'processing' temperatures, and by the use of good quality tin plate and efficient tin-closing methods to avoid causes of leakage and maintain the vacuum obtained."

A study of the preservation of fish in ice, L. H. ALMY, E. FIELD, and H. R. HILL (*Amer. Food Jour.*, 18 (1923), No. 1, pp. 36-38).—A study is reported from the Bureau of Chemistry, U. S. D. A., of the changes in appearance and in chemical composition of sea trout, mullet, and Spanish mackerel held in ice in the unviscerated and eviscerated conditions known as round and gutted, respectively.

The sea trout and mullet kept in a marketable condition for about 5 days longer than the Spanish mackerel. Regardless of species, the round fish which were full of feed spoiled more quickly than the corresponding gutted fish. The weight of the fish first increased and then decreased, those in the bottom layers showing a greater loss in weight and presenting a poorer appearance than those in the top layers. When stored for a long time both forms, but particularly the gutted fish, showed a loss in mineral and organic constituents.

The influence of various stimuli upon human saliva, J. R. McCLELLAND (*Amer. Jour. Physiol.*, 63 (1922), No. 1, pp. 127-141).—The effect of stimuli of various kinds upon human saliva was studied in four subjects, determinations being made on the saliva before and after the use of the various stimuli of pH values determined colorimetrically, the alkali and acid reserve, the buffer index, and the amylolytic index. The stimuli employed consisted of chewing various foods; rinsing the mouth with acids, sweetening agents, essential oils, and salts; and brushing the teeth with distilled water, common salt, and lime water.

The results obtained indicate that no general conclusion can be drawn as to the response of saliva to any stimulant. The saliva varied in all the properties tested, both with different individuals and with the same individual at different times, and the response to any particular stimulant varied with the individual.

Among the points noted are that mastication increases the pH value of the saliva temporarily, regardless of the flavor of the material, that the presence of alkalis in the saliva alters the H-ion concentration to a greater extent than the presence of acids, and that the addition of acid in the concentration required to precipitate mucin may be accompanied by danger to the teeth, since acid of this concentration is capable of dissolving the enamel.

Studies in inorganic metabolism, I-III (*Jour. Biol. Chem.*, 54 (1922), No. 2, pp. 363-397).—Three papers are presented.

I. Interrelations between calcium and magnesium metabolism, L. J. Bogert and E. J. McKittrick (pp. 363-374).—The investigation reported in this paper was undertaken to determine whether changes in the calcium intake would affect the urinary and fecal excretion of magnesium and vice versa. In this, as in the two following studies, a preliminary period on a calcium-low diet preceded the experiment proper for 4 days, and a similar period followed the close of the experimental period. The experimental period proper consisted of 4 4-day periods, the first on normal calcium-magnesium intake, the second high magnesium and normal calcium intake, the third the same as the first, and the fourth high calcium and normal magnesium. The basal diet consisted of bread, lean beef, apples, potatoes, rice, peanut butter, and milk. In the high calcium and high magnesium periods 6 gm. of calcium lactate and 6 of magnesium citrate, respectively, was taken in three equal doses daily. The feces and urine for each period were analyzed for calcium by the McCrudden method and for magnesium by the Official method. The diet of 2 of the 4 young women who served as subjects furnished 2,000 calories, 62 gm. of protein, 48 of fat, 0.266 of calcium, and 0.275 of magnesium. The diet of the other two subjects furnished 2,208 calories, 66 gm. of protein, 57 of fat, 0.309 of calcium, and 0.292 of magnesium.

All of the subjects remained in good health during the experimental period. The calcium intake of the basal diet proved too low for a positive balance, but the negative balances were small in all cases. From the results obtained it is concluded that the calcium requirements for the 4 subjects ranged from about 0.27 to 0.42 gm. per day, which figures correspond closely to the theoretical requirements as stated by Sherman (E. S. R., 40, p. 174). Based on the magnesium balances of the first period, which were all positive, the magnesium requirements of the 4 subjects ranged from 0.10 to 0.2 gm.

In 2 of the subjects the urinary excretion of magnesium was less than that of calcium, while in the other 2 subjects the reverse was true, thus confirming the conclusion of Nelson and Burns (E. S. R., 36, p. 366) that either calcium or magnesium may be in excess in the urine and that whichever predominates does so consistently for each individual. The fecal magnesium was less than the calcium in all 4 subjects during the first period. The addition of 6 gm. of magnesium citrate per day to the experimental diet increased both urinary and fecal magnesium in all 4 cases, the urinary and fecal calcium in 3 cases, and the total calcium in all cases. The addition of 6 gm. of calcium lactate per day increased both urinary and fecal calcium in all 4 cases. It appeared to increase the urinary magnesium in 2 cases, and slightly to increase the fecal and total magnesium in all 4 cases, although the after effects of the magnesium citrate taken in period 2 made it impossible to draw definite conclusions in regard to this point.

II. *The effects of acid-forming and base-forming diets upon calcium metabolism*, L. J. Bogert and E. E. Kirkpatrick (pp. 375-386).—In this study the same general methods were used as in the above report and also the same foods, with the addition of canned peas and hard-boiled eggs. In the first and third of the 4 periods following the preliminary calcium-low period, the diet was selected to furnish a balance between acid- and base-forming foods, in the second an excess of base-forming, and in the fourth an excess of acid-forming foods. The balanced diet consisted of beef, peanut butter, bread, rice, potatoes, milk, apples, butter fat, and sugar; the base diet of apples, milk, peas, potatoes, peanut butter, and sugar; and the acid diet of bread, rice, eggs, milk, butter fat, and sugar. These diets were planned to meet the requirements for energy, protein, and calcium, and to yield uniform amounts of energy, protein, calcium, and fat in all 4 periods, but the calcium, as in the first study, was too low and was also variable in amount, thus making it impossible to draw conclusions as to the influence of the acid-base content of the diets upon calcium retention.

The base-forming diets resulted in every case in a decrease in urinary calcium, and the acid-forming diets in a marked increase in urinary calcium in 3 of the 4 subjects. The base-forming diets showed a tendency to divert the calcium from the urine to the feces, and the acid-forming diets the opposite. Three of the 4 subjects showed a noticeable increase in total calcium excretion, and 2 showed increased negative calcium balances not to be accounted for by calcium deficiency in the diet during the period in which the acid-forming diets were consumed.

The total calcium excretion on the base-forming diet was lower than in the preceding period in 3 subjects and about the same in the fourth. It is concluded tentatively that calcium is retained somewhat more readily on a basic diet than on a balanced or acid-forming diet.

III. *The influence of yeast and butter fat upon calcium assimilation*, L. J. Bogert and R. K. Trall (pp. 387-397).—In the third study of this series the effect of the vitamin content of the diet upon calcium metabolism was studied by the use in the first and third periods of a diet low in vitamins, in the second

period a diet high in vitamin B, and in the fourth period one high in vitamin A. The low vitamin diet consisted of lean beef, rice, skim milk, white bread, sugar, cornstarch, and purified fat from nut margarin. Skim milk powder was used in place of fresh whole milk and was subjected to high temperatures by cooking with the rice in a pressure cooker. In the second period vitamin B was furnished in the form of six cakes of compressed yeast daily, and in the fourth period an equal weight of butter fat was substituted for the nut margarin. The diets met the energy and protein requirements and in nearly every case the theoretical calcium requirements.

The addition of yeast to the vitamin-free diet was followed in 3 of the 4 subjects by a lowered excretion of calcium, resulting in a change from a negative to a positive balance in 2 cases and equilibrium in the third case. In 1 subject the ingestion of yeast appeared to have little effect upon the calcium excretion. The substitution of butter fat for nut margarin resulted in all cases in decreased calcium elimination. These results are thought to indicate either an improved absorption or a decreased elimination of calcium through the intestinal wall during the periods in which yeast or butter fat was taken, and to suggest some influence of the vitamin content of the diet upon calcium assimilation.

Reproduction on synthetic diets when purified agar is added to the mixture, H. S. MITCHELL (*Amer. Jour. Physiol.*, 62 (1922), No. 3, pp. 557, 558).—Attention is called to the experience of various investigators in failing to secure reproduction in rats on the Osborne and Mendel standard diet of casein 18, starch 51, salt mixture 4, butter fat 9, and Crisco 18 per cent, with 0.4 gm. of dried yeast daily. In the author's experience with this diet, it was observed that in a few cases where pregnancy occurred the animals died before delivery or the young were dead or died soon after birth, and that in practically all these cases there was noted, on autopsy, a severe intestinal obstruction. This observation suggested the possibility of improving the ration by the addition of roughage.

Following this suggestion, 5 per cent of purified agar was substituted for an equal weight of starch in the above diet. Two females which had been mated without result when on the standard casein diet were again mated with the same male after the change in the diet and the following month produced and raised litters of 7 and 10, respectively, and two younger females raised on the modified diet have each produced a normal healthy litter.

Dried milk powder in infant feeding, T. CLARK and S. D. COLLINS (*Pub. Health Rpts. [U. S.]*, 37 (1922), No. 40, pp. 2415-2433, fig. 1).—This is the complete report of the results of an investigation covering a period of over 12 months of the value of dried milk in infant feeding as compared with grade A milk in suitable modifications and a reconstructed milk prepared from skim milk powder and butter fat. A preliminary report by Price, covering the first three months of this investigation, has been noted previously (*E. S. R.*, 43, p. 566). The later studies were continued along the same lines as the preliminary work, and, in addition, the investigation was extended to include laboratory studies comprising examinations of milk prepared in homes of different degrees of cleanliness, a classification of the intestinal flora of a number of babies from each group, and the physical examination of babies of all groups with reference to the extent of rickets and scurvy. Determinations by Talbot of the basal metabolism of a number of these babies have already been noted (*E. S. R.*, 46, p. 756).

The number of babies who were under observation for a sufficient length of time to furnish reliable data was 241, including 63 in group 1 on grade A milk,

138 in group 2 on dried milk, and 40 in group 3 on reconstructed milk. Data on the gain in weight are tabulated and also presented in curves showing the rate of growth of the subjects on the three diets, grouped for all ages for 35 weeks, for babies from 1 to 3 months old for 35 weeks, and from 4 to 6 months old for 24 weeks. These data tend to confirm the conclusion of the preliminary report that infants on whole milk powder gain in weight more rapidly than those fed modified cow's milk. In regard to group 3, the number of observations is considered too small to warrant definite conclusions, although in each case the tendency appeared to be toward a slightly lower rate of growth than with the whole milk powder.

The bacteriological study of the intestinal flora of 110 specimens received from 24 babies through a period of 10 weeks and of 2 breast-fed babies serving as controls gave in total count of microorganisms the following results: Breast-fed, 324,000; group 2, whole milk powder, 980,000; group 1, grade A, 1,130,000; and group 3, reconstructed, 1,140,000 per milligram. Milk prepared from whole milk powder gave a much lower bacterial count when freshly prepared and showed a smaller increase on standing than did either of the other two milks. Both whole milk powder and reconstructed milk gave results for Gram-positive and Gram-negative organisms in the feces similar to those of babies fed grade A milk, the Gram-negative organisms being higher and the Gram-positive lower than in the stools of breast-fed babies.

With regard to the relation of the different diets to the development of scurvy and rickets, it was considered advisable as a routine measure to administer orange juice to all the babies, but for various reasons 13 failed to receive it. Of these, 2 developed scurvy, 1 on grade A milk and 1 on reconstructed. A number of children in all groups showed evidences of rickets, but no difference could be noted in the different groups with respect to this disease.

The sulphuric acid reaction for liver oils, J. C. DRUMMOND and A. F. WATSON (*Analyst*, 47 (1922), No. 557, pp. 341-349).—The sulphuric acid color reaction for liver oils, the violet color produced when one drop of concentrated sulphuric acid is added to a solution of the oil in a solvent such as chloroform or petroleum ether, has been made the subject of an extensive study with respect to a possible association between this reaction and vitamin A. In the course of this investigation the substance responsible for the color has been found in the livers of the following species: Man, horse, ox, pig, cat, monkey, rabbit, guinea pig, chicken, duck, pigeon, rat, mouse, frog, shark, cod, haddock, ling, coal-fish, dog-fish, sprat, and skate. That the bile constituents of the liver are not responsible for the color reaction has been proved by negative results obtained with fresh bile and with the unsaponifiable fractions prepared from bile. On saponification of the oil the substance responsible for the color test is found in the unsaponifiable fraction and is not removed from this fraction by decolorizing agents such as Norit, thus indicating that it is not associated with lipochrome pigments. It is easily destroyed by oxidation, but is stable to temperatures below 120° C. if protected from oxidation by a current of carbon dioxide.

An application of the test to the liver and body fats of pigs used in a previously reported study by Drummond et al. (*E. S. R.*, 45, p. 586) showed a further relation between this substance and vitamin A in that the liver fat of the pigs fed on diets deficient in vitamin A did not give the characteristic color test, while not only the liver fat, but in some cases the body fat also, of other pigs fed on diets rich in vitamin A give the test. Rats fed on diets rich in vitamin A also give the color test occasionally in the body fat as well as the liver fat.

A rough approximation of the power of different oils to give the test has been made by using a series of dilutions of the oil in petroleum ether and determining at what dilution the color reaction is just given with one drop of sulphuric acid. On determining in this way the color index of a number of samples of cod liver oil whose relative activity as sources of vitamin A was known, the color tests were found to vary in the same order as the vitamin activity. This colorimetric procedure was also used to predict the vitamin activity of a number of oils which had not been tested on rats. In nearly every case consistent results were obtained. Progressive destruction by aeration of the vitamin A in a potent sample of cod liver oil was found to be accompanied by similar destruction of the ability to give the color reaction.

Attempts to obtain evidence of the presence of the chromogenic substance in various marine and animal plants known to contain vitamin A are reported with varying success. In attempts to trace the origin of the substance in cod liver oil, no trace of the color reaction could be obtained from the diatom *Nitzschia* nor from the mixed plankton which forms the food of the young fish, but the small fish which live on the mixed plankton and which serve in turn as food for the cod contained the chromogenic substance in the liver.

Vitamins, exposure to radium and intestinal fat absorption, J. C. MOTTRAM, W. CRAMER, and A. H. DREW (*Brit. Jour. Expt. Path.*, 3 (1922), No. 4, pp. 179-181, pl. 1).—An investigation is reported of the mode of absorption of fat by the epithelial cells of rats on a vitamin-free diet with additions of olive oil, olive oil and marmite (yeast extract), cod liver oil, and cod liver oil and marmite, respectively, and also of the effect of radiation on the absorption of fats on these various diets. The animals were kept without food for 20 hours and then were fed at a given time with the different foods and killed some hours later. Pieces of the small intestine equidistant from the pylorus were cut out, fixed in formalin, transferred to a solution of 1 per cent osmic acid in 1 per cent chromic acid, and the tissue finally examined in paraffin section.

Two methods of fat absorption are described and illustrated. The first, to which the name "absorption by drops" is given, is characterized by an appearance of droplets of fat between the free border of the cells and the nucleus. In the second type of absorption, "absorption by streams," the fat is in a much more finely divided form. It was found that when the food contained no vitamins the fat was absorbed entirely by drops. When vitamin A was present but not vitamin B the absorption was largely by drops, with a few streams. In the presence of vitamin B and absence of vitamin A the absorption was almost entirely by streams and in the presence of both vitamins entirely by streams.

In the radiation experiments no absorption of fat occurred when the animals received a large dose of screened radiation, even in the presence of both vitamins. With a smaller dose absorption by drops only occurred whether or not vitamins were present. With a still smaller dose olive oil with vitamin B gave drops only, and cod liver oil, containing vitamin A, with the further addition of vitamin B drops with a few slight streams.

The differences in absorption of fat noted in the various experiments are thought to indicate differences in the functional state of the intestinal epithelium with regard to food, and to give evidence that "vitamins A and B, particularly the latter, produce a definite stimulating action on the processes of intestinal digestion and absorption. The presence of lymphocytes in the intestine is an even more important factor."

Yeast as a source of vitamin B for the growth of rats, C. KENNEDY and L. S. PALMER (*Jour. Biol. Chem.*, 54 (1922), No. 2, pp. 217-232, figs. 3).—This contribution from the Minnesota Experiment Station consists of the report of an investigation of the value, in comparison with an alcoholic extract of wheat

embryo, of different kinds of yeast as a source of vitamin B for purified rations. The basal diet employed consisted of purified casein 18, salt mixture 8.7, agar 2, and butter fat 5 per cent, with dextrin to make 100 per cent. Vitamin B was furnished in the form of dried yeast from various sources, administered first as a part of the ration, and in the later experiments separately in the form of tablets. In reporting the results, calculations were made of the nitrogen supplied by the yeast and of the actual weight of pure yeast in the various samples, some of which were diluted by the use of a filler. The yeasts used included baker's yeast (Fleischmann), brewery yeast obtained fresh and dried in the laboratory, a pure culture of *Saccharomyces cerevisiae*, Fleischmann's starch-free yeast dried in the laboratory, and a similar variety obtained ready dried.

The results obtained are considered not to support the general belief that yeast is an unusually valuable source of the growth-promoting vitamin B, nor that it can be accepted as a standard product in experiments in which vitamin B is required. The administration of the yeast separately from the basal ration gave better results than its incorporation with the ration, but even under the most favorable conditions completely satisfactory growth was not obtained. Owing to the change of one form of yeast to another during the course of the experiments and to increases in the dosage at rather frequent intervals, a comparison of the relative values of the different kinds of yeast is difficult to make. As compared with the alcoholic extract of wheat embryo all the yeasts employed appeared to be less favorable and certain as a source of vitamin B. Failure of rats to reproduce normally and rear their young was noted in practically every case in which yeast furnished vitamin B. The amount of unknown material added to an otherwise purified ration is shown to be greater in the case of yeast than of the alcoholic extract of wheat embryo, and to furnish a further argument against the use of yeast as a source of vitamin B.

The synthesis of water-soluble B by yeast grown in solutions of purified nutrients. M. B. MACDONALD (*Jour. Biol. Chem.*, 54 (1922), No. 2, pp. 243-248, figs. 3).—Several varieties of yeast grown on the medium of purified nutrients previously noted (E. S. R., 45, p. 866) and also on standard nutrient solutions have been used as the sole source of vitamin B for young rats for a period of about 4 weeks following the cessation of growth on the basal diet alone. In all cases the introduction of the air-dried yeast to the extent of 50 per cent of the basal ration resulted in prompt recovery of growth. It is stated, however, that while the animals gained in weight, their coats were not sleek nor was their general appearance up to the standard. The results are interpreted as indicating not so much the practical value of yeast as a source of vitamin B as that, in so far as its content of vitamin B is concerned, yeast grown in solutions of purified nutrients behaves like yeast grown in other mediums, and that hence it must have the power of synthesizing vitamin B.

The rôle of microorganisms in the production of vitamins.—Studies on the production of growth-promoting vitamins by *Bacillus bulgaricus* and *Amylomucor*, E. WOLLMAN and M. VAGLIANO (*Compt. Rend. Soc. Biol. [Paris]*, 86 (1922), No. 15, pp. 832, 833).—Evidence is presented from growth experiments with rats that *B. bulgaricus* and *Amylomucor* are not capable of synthesizing vitamin A or the growth-promoting vitamin B. Similar studies of the possible synthesis of the antineuritic vitamin B and vitamin C have been reported previously with negative results (E. S. R., 46, p. 866.)

Growth and the antiscorbutic substance. G. MOURIQUAND, P. MICHEL, and L. BARRÉ (*Compt. Rend. Soc. Biol. [Paris]*, 86 (1922), No. 19, pp. 1167-1169).—

From a comparison of the gain in weight and increase in size of guinea pigs fed on diets containing vitamin C with those on diets furnishing none or only limited amounts of this vitamin, the authors conclude that vitamin C in itself has no growth-promoting properties.

Studies on the content of diastatic enzyme in the pancreas of polyneuritic pigeons. E. ROTHLIN (*Hoppe-Seyler's Ztschr. Physiol. Chem.*, 121 (1922), No. 4-6, pp. 300-306).—Determinations are reported of the amount of maltose obtained from a given weight of starch under identical conditions by artificial digestion with the pancreatic extracts of healthy and of polyneuritic pigeons. No evidence was obtained of any difference in diastatic action, nor did the injection of hydrocyanic acid alter the diastatic action of the pancreas.

The hematology of polyneuritic pigeons. E. WEILL, F. ARLOING, and A. DUFOURT (*Compt. Rend. Soc. Biol. [Paris]*, 86 (1922), No. 19, pp. 1175, 1176).—The blood of pigeons fed polished rice is said to be characterized by a progressive lowering of the number of red blood cells and of the hemoglobin count and an increase in the number of leucocytes.

Studies on experimental rickets.—XXIII, **The production of rickets in the rat by diets consisting essentially of purified food substances.** E. V. MCCOLLUM, N. SIMMONDS, J. E. BECKER, and P. G. SHIPLEY (*Jour. Biol. Chem.*, 54 (1922), No. 2, pp. 249-252).—To serve as a check on the accuracy of the conclusions drawn in the previous studies of this series (E. S. R., 48, p. 563), in which the diets used were made up chiefly of foods of a complex character, the studies have been extended to include the effects of feeding diets consisting essentially of purified materials. In this paper two such diets, which are said to have resulted in typical rickets, are described. The first consists of wheat germ (extracted with ether and chloroform) 3 per cent, wheat gluten purified 15, gelatin 15, agar 2, salt mixture 3.9, CaCO_3 1.5, dextrin purified 56.96 $\text{NaH}_2\text{PO}_4 + \text{H}_2\text{O}$ 0.64, and butter fat 2 per cent. The second consists of wheat germ 3, wheat gluten 5, gelatin 5, casein 5, agar 2, salt mixture 3.9, CaCO_3 1.5, dextrin 72.6, and butter fat 2 per cent, the various ingredients being purified as in the first ration.

It is stated that the animals restricted to these diets not only developed rickets but also showed signs of xerophthalmia, notwithstanding the presence of sufficient vitamin A to cover the minimum nutritive needs of the rat. This "salt ophthalmia" has been noted in a previous paper (E. S. R., 48, p. 464).

Experimental rickets in rats.—IX, **The distribution of phosphorus and calcium between the skeleton and soft parts of rats on rachitic and non-rachitic diets.** G. F. MCCANN and M. BARNETT (*Jour. Biol. Chem.*, 54 (1922), No. 2, pp. 203-212).—In this continuation of the series of studies on experimental rickets in rats (E. S. R., 48, p. 365), data are reported on the phosphorus and calcium content of the bones and soft tissues of rats which had been kept for 4 weeks after weaning on a normal diet; on diet 84, characterized by low phosphorus, high calcium, and poor vitamin content; on diet 85 C, characterized by high phosphorus, low calcium, and poor vitamin content; and on diet D, characterized by low phosphorus, high calcium, good protein, vitamin A, and probably vitamin B. Poor growth and rickets resulted from diets 84 and 85 C and fair growth with rickets from diet D. Two series were also kept on diet 84, supplemented in one case with cod liver oil and in the other with light treatment, both of which prevented rickets.

The normal rats contained from 0.52 to 0.70 gm. of phosphorus and from 0.72 to 0.98 gm. of calcium per 100 gm. of body weight. Corresponding values for rats in which rickets had been prevented by cod liver oil or light were from 0.53 to 0.72 gm. P and from 0.79 to 1.20 gm. Ca. The rats on diet 84 contained

from 0.45 to 0.49 gm. P and from 0.60 to 0.81 gm. Ca; on diet D from 0.38 to 0.42 gm. P and from 0.41 to 0.47 gm. Ca; and on diet 85 C from 0.45 to 0.49 gm. P and from 0.66 to 0.72 gm. Ca per 100 gm. weight. These data show that rachitic rats contain less phosphorus and calcium per unit weight than normal rats, particularly in the case of animals making fairly good growth on the rachitic diets.

In the normal rats from 68 to 75 per cent of the total phosphorus was found in the bones, in rats developing rickets on diet 84 with poor growth and from 68 to 71 per cent, and in rats on diet D developing rickets while growing fairly well from 46 to 62 per cent. This is thought to indicate that in the more rapidly growing animals the soft tissues are able to take up and retain a greater proportion of the phosphorus, thus reducing the share of the bones below that which is found when growth is not so rapid.

No significant changes were found in the distribution of calcium between bone and tissue.

The nature of the action of potato upon the growth of *Bacillus influenzae*, P. FILDES (*Brit. Jour. Expt. Path.*, 3 (1922), No. 4, pp. 210-214).—The authors present evidence of a similarity in behavior between Thjötta and Avery's growth-promoting factor X of the potato (*E. S. R.*, 46, p. 78) and the similar factor in blood, in that the potato extract has the property previously noted of the blood factor (*E. S. R.*, 46, p. 79) of oxidizing guaiaconic acid in the presence of a peroxid. It is also noted that the peroxidase in potato has a similar reaction to heat and absorption, as has the growth-inducing factor of potato. "It is suggested that the stimulating action of potato upon the growth of *B. influenzae* is due to the action of the peroxidase enzym operating in the same manner as blood pigment to accelerate the transfer of atmospheric oxygen to the bacillus."

ANIMAL PRODUCTION.

Francis Galton, 1822-1922: A centenary appreciation, K. PEARSON (*London: Cambridge Univ. Press*, [1922], pp. 23, pl. 1).—This is a brief review of the more noteworthy contributions of Galton, with special reference to the part which he played in developing the science of eugenics.

On the mechanism of heredity, T. H. MORGAN (*Roy. Soc. [London] Proc., Ser. B*, 94 (1922), No. B659, pp. 162-197, pls. 2, figs. 31).—This is a discussion of the present knowledge of heredity and describes mitosis, maturation, linkage, crossing over, and nondisjunction in *Drosophila melanogaster*, with comparative results for other species. The methods of calculating chromosome maps and the reasons for believing in the linear arrangement of genes are presented.

The standard deviations of fraternal and parental correlation coefficients, K. SMITH (*Biometrika*, 14 (1922), No. 1-2, pp. 1-22).—Formulas for determining the standard deviation of fraternal and parental correlation coefficients have been deduced and applied to the results on inheritance in fish previously reported by the author (*E. S. R.*, 46, p. 268). The formulas are calculated on the basis of normal distribution and normal correlation, including an equal number of offspring from each family.

The inheritance of fur types and hair characters in rabbits, R. N. SALAMAN (*Jour. Genetics*, 12 (1922), No. 2, pp. 179-207, figs. 24).—A study of the characters of the hair and fur of 90 pedigreed rabbit skins which were preserved by C. C. Hurst is reported. In making the study small bunches of hair were removed from the hide and fixed for sectioning. Microscopical examinations were then made of the cross sections of the bunch of hair from the base to the tip.

It was found that there were two different types of pelts, known as types A and B, which were differentiated largely by the frequency and shape of the cross sections of the contour hairs, these being the stout hairs from the hide. These hairs were found to vary in shape at different levels. In the type A pelts there was about one contour hair to 20 finer hairs, whereas in the B type the ratio was from 1:50 to 1:70. In the A-type pelt the counter hairs were bean-shaped at the base, changing gradually to kidney-, sausage-, and finally dumb-bell shape at the point of greatest diameter, which may be 10 times the diameter of the base. Toward the distal end the hairs lose their dumb-bell shape by the ends being flattened, and they gradually become ribbon-like, ending in a fine whip point. In the B-type of pelt the contour hairs are almost circular throughout their length except near the end, where they are usually flattened or bean-shaped before ending in a whip point. These hairs ordinarily contain one medulla, but may contain two or three, rarely more, whereas the hairs in the A-type pelt contain from one to four medullas near the base, increasing to from 12 to 15 in the dumb-bell shaped portion. In the A-type pelts the small hairs are of two kinds, one of which resembles the contour hairs, but in the B-type pelts they are smaller and of but one kind. In noting the relationship between the different types of pelt and the length of hair it was found that all the short-haired rabbits had pelts of the A-type, whereas part of the long-coated or Angora rabbits were of each type.

In dealing with the inheritance of the two types of pelts it is concluded that the A type is dominant to the B type. The B type was only to be found in the long-coated rabbits, and was not associated with any color or with the Dutch pattern.

The small hairs were of three shapes on cross section, square, round, and oval. The square-shaped hairs were found pure only in short-coated rabbits and were recessive to the other two shapes. The round-shaped hairs have been found to be associated with B-type pelts, but round hairs were also found in both long- and short-haired rabbits and in the black of the Dutch-marked rabbits, whereas square hairs were found in the white of the Dutch rabbits. The round shape was recessive to the oval. The oval shape occurred in both long- and short-haired coats, but was usually mixed with some round and square hairs. Mixing also occurred in case of the other shapes to some extent.

Postaxial polydactylism in six generations of a Norwegian family, A. SVERDRUP (*Jour. Genetics*, 12 (1922), No. 3, pp. 217-240, pls. 6, fig. 1).—An account is given of the polydactylism which occurred in six generations of a family descended from one woman in which this condition occurred. Of the 57 children from 12 marriages on which determinations were made, 34 were polydactylous and 23 were normal. Two types of polydactylism were found in the family. In type A there was an equal splitting of the fifth digit in either hands or feet, whereas in type B the sixth digit was represented by a small, loosely attached appendage.

From the observations of the method of inheritance of these types it was found that polydactylous individuals have only occurred when one of the parents was polydactylous, indicating that the condition is dominant. Either the A or B type of polydactylism occurred in the offspring of a parent showing the A type of polydactylism, but only the B type resulted from a parent possessing the B type. This led to the conclusion that "the A type polydactylism most probably is due to the operation of cumulative factors, whereas the B type is produced by one Mendelian factor possibly sometimes in connection with factors suppressing its development."

Some brachydactylism accompanied the type A. polydactylism in this family, but it is concluded that this condition is due to a separate hereditary factor which is possibly linked with one of the factors for polydactylism. Radiographs of a large number of the polydactylous hands and feet of the members of the family are included.

Diallel crossings with the domestic fowl, J. SCHMIDT (*Jour. Genetics*, 12 (1922), No. 3, pp. 241-245).—The generative value of two cocks was determined by the method of diallel crossings (E. S. R., 47, p. 864) with five hens at the Carlsberg Laboratory, Copenhagen. The character studied was again the number of vertebrae in the chickens, which were found to vary from 39 to 44. The five differences between the average generative values of the two cocks, as determined by the crosses with the individual hens, varied from 0.63 to 0.69. This is such a close agreement that the author believes the principle of diallel crossings should be applicable to experiments with poultry in which quantitative characters are considered. Both of the cocks used were found to have 42 vertebrae.

Sex linkage in the silkworm, Y. TANAKA (*Jour. Genetics*, 12 (1922), No. 2, pp. 163-178, pl. 1).—The results are reported of eight experiments in crossing silkworms which were carried on at the University of Kyushu, Japan, to study the method of inheritance of a character called translucent, which has been designated as oily in an earlier paper (E. S. R., 37, p. 158). The author found that there were at least eight independently inherited factors for translucence which were all recessive to the normal, but a homozygous condition of any one would produce the translucent character. One of these factors was found to be sex linked, and it is to this one that most attention is given in the present paper.

The number of translucent silkworms which occurred in the crosses were as a rule somewhat below expectation, especially in the females, though the cause for this was not determined. According to the method of inheritance of the sex-linked factor, sex determination was found to be of the W Z type in the silkworm.

Linkage relations of the sex-linked characters in *Drosophila obscura*, D. E. LANCEFIELD (*Genetics*, 7 (1922), No. 4, pp. 335-384, figs. 3).—The present paper describes 28 sex-linked characters in *D. obscura*.

Some of these characters have been found to be arranged in multiple allelomorphous series so that the genes causing them occur in 23 different loci. By studying the crossing over which has occurred between a number of the factors, it has been possible to construct a map showing 17 different loci for genes responsible for these characters. From cytological studies the X-chromosome in this species has been found to be much longer than in *D. melanogaster* or *D. virilis*. This observation is substantiated by the fact that the map of the X-chromosome has been calculated to be 170 units long.

The possibility of characters in *D. obscura* being similar to like characters in *D. virilis* or *D. melanogaster* is discussed, with negative conclusions in most cases, though it has been stated that the factors for notched wings and white-eosin eye color may be similar in *D. melanogaster* and *D. obscura*. The loci for these genes, however, are near the center of the chromosome in *D. obscura* and on the end in *D. melanogaster*. This leads to the assumption that the large size of the X-chromosome in *D. obscura* is due to the attachment of a large piece of a chromosome to the hook end of the X-chromosome in *D. melanogaster*.

An eyeless mutant in *Drosophila hydei*, R. R. HYDE (*Genetics*, 7 (1922), No. 4, pp. 319-334).—The occurrence in *D. hydei* of a mutant called variable in which the eye varies from the normal size to practically an eyeless condition

is described. A series of experiments carried on at the Johns Hopkins University have shown that the factors for variable and scarlet eyes are linked. In crosses the variable eye condition is recessive to normal eyes. The method of inheritance of variable is apparently effected by environmental conditions, for when cultures homozygous for variable are kept cool and moist, nearly all or in many cases all the offspring which develop are normal eyed, but when the cultures are dry and warm large numbers of small eyed or practically eyeless individuals are produced. The environmental influence determining whether the eye of the homozygous variable shall be large or small was shown to be exerted after the egg is fertilized and deposited. Reference is made to several other cases where environmental conditions have modified characters in *Drosophila*.

The inheritance of ski wings in *Drosophila melanogaster*, R. E. CLAUSEN and J. L. COLLINS (*Genetics*, 7 (1922), No. 4, pp. 385-426).—A character known as ski wings is described which resembles jaunty and curled, but which was found to be distinct from them in experiments carried on at the University of California. It was determined that ski differs from the wild type in two genes, one a dominant gene $S_{I\pi}$ located in the second chromosome, and the other a recessive gene S_{Im} located in the third chromosome. In order that the ski character be evidenced, S_{Im} must be homozygous and $S_{I\pi}$ may be either heterozygous to produce the simplex condition of ski or homozygous for the complete ski character. Ski in the simplex condition is not so pronounced as when duplex. The locus of $S_{I\pi}$ was placed at 30.8 in the second chromosome by making back crosses in which the characters star and black were concerned. All of the flies used for these determinations were homozygous for S_{Im} . The locus for the latter factor, S_{Im} , was determined at 43.4 in the third chromosome in a similar manner by using flies homozygous for $S_{I\pi}$ and using as a basis for the determinations the genes causing the characters dichaete and spineless. Neither $S_{I\pi}$ nor S_{Im} produced any somatic change except when acting together.

One-sided masculine and sex-linked inheritance in *Lebistes reticulatus*, Ø. WINGE (*Jour. Genetics*, 12 (1922), No. 2, pp. 145-162, pls. 2).—This is an account of crossing experiments with the fish *L. reticulatus* carried on in the genetic laboratory of the Royal Veterinary and Agricultural College at Copenhagen. Four sets of characters determined by factors carried in the Y-chromosome and two sets of characters determined by factors carried in the X-chromosome were observed as to their method of inheritance in crosses. None of the factors studied were evidenced in the females. Those factors carried in the X-chromosome showed sex-linked inheritance, whereas those carried in the Y-chromosome showed one-sided masculine inheritance as distinguished in a previous note (E. S. R., 47, p. 667). The observed results were in very close agreement with the expected, but one male occurred which was entirely unexpected and its occurrence is explained as due to crossing over between the X- and Y-chromosomes, this being the first case of this phenomenon yet reported.

It should be noted that this fish differs markedly from *Drosophila* in that the greater portion of the color factors seem to be carried by the Y-chromosome, but the author predicts that by crossing over it may be possible to find or produce *Lebistes* males without color factors in the Y-chromosomes.

The genetic significance of intra-uterine sex ratios and degenerating fetuses in the cat, E. E. JONES (*Jour. Heredity*, 13 (1922), No. 5, pp. 237-239).—A sex ratio of 122.1 ± 8.3 was obtained for 653 embryos recovered from 148 pregnant cats killed by the Society for the Prevention of Cruelty to Animals

in New York City. This ratio agrees rather closely with the sex ratio of 123.21 as found by Jewell for fetal cattle (E. S. R., 47, p. 668). The possibility of a differential intra-uterine mortality is suggested though no data are available on the sex ratios of cats at birth for comparison.

The mean litter size of the 25 females which were classified as white (not more than 10 per cent of the area of the coat colored) was 4.08 ± 0.13 as compared with a litter size of 4.48 ± 0.15 for the nonwhites. In the fetuses from the white females 10.78 ± 2.07 per cent were degenerating, whereas only 3.84 ± 0.58 per cent of the fetuses from the nonwhite females were degenerating. The difference of 6.845 ± 2.149 is considered significant, and it is concluded "that in some white female cats at least a lethal action of some sort is operative when the factor for white is present even in the simplex condition." The possible relationship is noted to a similar lethal factor in mice previously reported by Little (E. S. R., 44, p. 67).

Sex ratio and unisexual sterility in hybrid animals, J. B. S. HALDANE (*Jour. Genetics*, 12 (1922), No. 2, pp. 101-109).—After reviewing a large number of experiments dealing with abnormal sex ratios or sterility of one sex in hybrids of Lepidoptera, Diptera, birds, and mammals, the author concludes that "when in the F_1 offspring of two different animal races one sex is absent, rare, or sterile, that sex is the heterozygous sex." The possible exceptions to this rule were found in Lepidoptera, but all except one of these cases were doubtful.

The nature of certain ovum-like bodies found in the seminiferous tubules, F. A. E. CREW and H. B. FELL (*Quart. Jour. Micros. Sci. [London]*, n. ser., 66 (1922), No. 264, pp. 557-578, pls. 6).—An histological study has been made of ova-like bodies which have been found in undescended testicles from a goat, rabbit, cat, and frog. These bodies were identified as degeneration products of the germinal epithelium of the seminiferous tubules, and it is suggested that bodies resembling ova which have previously been found in testicles were probably similar.

A hen with two ovaries? H. ATWOOD and H. SNYDER (*Poultry Sci.*, 2 (1922-23), No. 2, pp. 59-61).—This is an account of a hen which has been found at the West Virginia Experiment Station to lay eggs of two distinct types, one being long and the other shorter and rounder. It is assumed that this hen has two sets of ovaries and oviducts.

The influence of subcutaneous injections of indol and skatol upon the nitrogenous metabolism of the rabbit, F. P. UNDERHILL and R. KAPSINOW (*Jour. Biol. Chem.*, 54 (1922), No. 4, pp. 717-720).—Injections into 4 rabbits of 30 mg. of indol or skatol per kilogram of live weight were found to be without influence on the amount of nitrogen excreted in the urine. Indol appeared to somewhat increase the excretion of ethereal sulphates, but this was not true with the injections of skatol.

Investigations of the composition and digestibility of foreign fodder peas, F. HONCAMP and K. MONTAG (*Landw. Vers. Sta.*, 99 (1921), No. 1, pp. 41-51).—Determinations of the composition and digestibility of the chick-pea or gram (*Cicer arietinum*), mattar pea (*Lathyrus sativus*), Indian pea or Calcutta pea, and Russian pea are reported.

The digestibility was determined by feeding two wethers in six feeding periods of 10 days each. During the first and sixth feeding periods a basal ration of 700 gm. of meadow hay was fed each wether, and during the second, third, fourth, and fifth periods 300 gm. of Calcutta peas, Russian peas, gram, and mattar peas, respectively, were added to the basal ration. The composition and average digestibility of the fodder peas were determined as follows:

Composition and average digestibility of fodder peas.

Kind of peas.	Composition.						Coefficient of digestibility.				
	Dry matter.	Crude protein.	Ether extract.	Crude fiber.	N-free extract.	Ash.	Or- ganic matter.	Crude protein.	Ether extract.	Crude fiber.	N-free extract.
	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>
Calcutta.....	83.39	25.83	1.14	5.97	63.82	3.24	89.6	85.0	69.7	59.3	94.7
Russian.....	83.64	27.14	1.28	4.61	64.24	2.73	88.4	85.7	63.9	59.3	91.5
Gram.....	85.28	22.60	4.79	9.39	59.97	3.25	82.8	77.8	88.2	59.3	87.8
Mattar.....	85.17	27.86	.84	7.48	51.90	11.92	83.4	83.0	70.0	66.2	87.4

The feeding of cattle by the method of feeding equivalents.—The use of a graphical method of calculating the rations of growing cattle, A.-M. LEROY (*Rev. Zootech. [Paris], No. 12 (1922), pp. 215-229, figs. 5*).—The usual method of calculating the rations of young cattle by determining the feed required for maintenance and that required for gain in weight separately is discussed, and the effect of rate of gain and the age of the animal on these requirements is shown graphically. A graph is then presented from which the total feed required by young cattle for both maintenance and growth may be determined in one operation for animals of different weights and making gains at different rates. A number of examples of the similarity of the results which are obtained by calculating rations by the two methods are given. A table of feeding equivalents used in the work is appended.

Steer feeding in Colorado, C. I. BRAY (*Colo. Agr. Col. Ext. [Bul.] 195 A (1922), pp. 40, figs. 21*).—This is a discussion of the best methods of steer feeding in Colorado, with reference to the most profitable types of steers, available feeds, and a review of some steer feeding tests carried on at the Colorado Experiment Station.

The properties and inheritance of wool of Leicester-Merino crosses, W. SPÖTTEL and E. TÄNZER (*Deut. Landw. Tierzucht, 26 (1922), No. 49, pp. 518-523, figs. 2*).—In classifying wool fibers of Merino and Leicester sheep similarly to the method employed by Voltz (*E. S. R., 48, p. 372*), it has been found that the Merino wool was uniformly fine, especially in selected flocks, whereas the wool of the Leicester sheep was extremely variable in the degree of fineness. Crosses between the two breeds were also variable as to fineness and resemblance to the Leicester and Merino wool in other characters.

Forage crops for hogs in Texas, A. L. WARD and A. K. SHORT (*Tex. Agr. Col. Ext. [Bul.] C-21 (1922), pp. 7, fig. 1*).—Forage crops for hogs are briefly discussed, followed by directions for sowing and grazing each crop. Suggested rotations of forage crops are also given.

Swine feeding, V. A. FREEMAN (*Mich. Agr. Col. Ext. Bul. 26 (1923), pp. 11, figs. 3*).—A discussion of the feeding value of the more common swine feeds is given. Sample rations for hogs of different ages are suggested, based on the protein and mineral requirements. Notes on methods of feeding and amounts to feed are included.

Feeding and management of breeding swine, W. E. JOSEPH (*Montana Sta. Circ. 107 (1922), pp. 21, figs. 14*).—General instructions for the feeding, selection, care, and management of brood sows, boars, and young pigs are given.

The essentials of a successful self-feeder for swine, J. M. EVVARD, J. B. DAVIDSON, and W. A. FOSTER (*Iowa Sta. Bul., 208 (1922), pp. 97-143, figs. 50*).—The advantages, disadvantages, and general requirements to be observed in

using self-feeders for swine are briefly noted, followed by plans and directions for constructing a number of different types of self-feeders.

The variation of eggs in the rate at which they lose weight, L. C. DUNN (*Poultry Sci.*, 2 (1922-23), No. 2, pp. 45-58).—This is the first paper in a series of studies dealing with the causes of death of chick embryos in the shell.

The percentage and actual loss in weight of eggs obtained from the moderately inbred flock of White Leghorns at the Connecticut Storrs Experiment Station was recorded. The mean loss in weight for 79 eggs kept 1 day was 0.1853 ± 0.0028 per cent, for 83 eggs kept 20 days 2.0673 ± 0.0415 per cent, for 250 eggs incubated 7 days 5.64 ± 0.05 per cent, for the 223 of these eggs which were fertile 5.607 ± 0.48 per cent, and for 92 fertile eggs incubated 14 days 10.67 ± 0.14 per cent.

The coefficient of variability of the unincubated eggs was about 27 per cent in each case, as compared with 18.5 to 19 per cent for the incubated eggs. The variability in the actual weight of the incubated eggs was approximately 8.5 per cent, indicating that there is greater variation in the rate of losing weight than in egg size.

The coefficients of variability of the weights of eggs from 6 individual pullets were found to range from 2.07 to 6.18 per cent, averaging 4.64 per cent. The variability in the rate of losing weight in these eggs ranged from 8.94 to 15.76, averaging 11.77 per cent for all the pullets. This indicates that the eggs from individual hens are about half as variable in weight and the rate in losing weight as eggs from the flock as a whole.

Poultry feeds and feeding, H. M. LAMON and A. R. LEE (*New York: Orange Judd Pub. Co.; London: Kegan Paul, Trench, Trübner & Co., Ltd., 1922, pp. 247, pls. 18, figs. 6*).—This book consists of three parts. The first part deals with the scientific principles of feeding poultry under such headings as the composition of plants, composition and structure of the fowl and of eggs, economical production of eggs and of poultry flesh, and feeding standards and the effect of different nutrients. In the second part the different poultry feeds are classified and described. Practical poultry feeding is taken up in the third part under the headings of method of feeding laying hens; egg-laying rations; feeding and fattening chickens; management of laying stock; feeding ducks, geese, turkeys, pigeons, and capons; and profit and economy in poultry feeding. A number of suggested egg-laying rations and tables showing the composition and digestible nutrients of poultry feeds are given in the appendix.

Ducks and geese, H. M. LAMON and R. R. SLOCUM (*New York: Orange Judd Pub. Co.; London: Kegan Paul, Trench, Trübner & Co., Ltd., 1922, pp. XIV+231, pls. 56*).—This book consists of two parts on ducks and geese, respectively, dealing in each case with the extent of the industry, breeds and varieties, mating, care, handling, preparation for show, location for commercial farms and equipment necessary, management of breeding stock, incubation, brooding, rearing, fattening, and marketing.

The breeding of skunk and other fur-bearing animals, F. G. HASSELMAN (*Ind. Dept. Conserv., Pub. 17 (1921), pp. 12, figs. 6*).—General methods of skunk breeding are briefly described, as well as a few notes on the breeding of muskrats, raccoons, opossums, and red foxes.

DAIRY FARMING—DAIRYING.

Comparison of corn ensilage and sunflower ensilage for dairy cows, W. L. QUAYLE (*Wyoming Sta. State Farms Bul. 3 (1922), pp. 11, fig. 1*).—During the winters of 1921 and 1922, 3 Holsteins and 3 Shorthorns were used

in experiments at the Archer Experiment Farm to compare Mammoth Russian sunflowers and corn silage for milk production. The tests consisted of 6 14-day feeding periods each year. The different silages were fed during alternate feeding periods, and while the Shorthorns were receiving corn silage the Holsteins received sunflower silage. The average daily ration consisted of 80 lbs. of silage, all the alfalfa hay the cows would eat, and a grain mixture composed of 7 parts corn meal, 2 parts bran, and 1 part cottonseed meal. The combined summary of the two tests is given in the following table:

Comparison of sunflower and corn silage for milk production.

Breed of cows.	Kind of silage.	Total number of days.	Average initial weight per head.	Average daily gain.	Average daily production.		Average daily feed consumed.		
					Milk.	Butter fat.	Grain.	Alfalfa.	Silage.
Shorthorn.....	Sunflower.....	84	Lbs. 1,087	Lbs. -0.13	Lbs. 27.37	Lbs. 1.00	Lbs. 10.33	Lbs. 15.13	Lbs. 29.83
Do.....	Corn.....	84	1,087	+3.10	27.87	1.01	10.33	15.59	29.93
Holstein.....	Sunflower.....	84	1,101	+ .80	35.01	1.07	12.00	17.01	29.93
Do.....	Corn.....	84	1,101	+2.00	36.05	1.11	12.00	16.84	29.98

The cows did not eat the sunflower silage as eagerly as they did the corn silage throughout the test, but the milk and fat produced by the two silages were nearly equal and the author concludes that "the practical dairyman will be substantially right in considering ensilage made from corn and that made from sunflowers as equivalent in feeding value, pound for pound." The gains in weight made by the cows on corn silage were somewhat larger than those made on sunflower silage. Sunflower silage, however, was found to be cheaper to produce than corn silage, as larger yields occurred per acre. In 1920, 6,500 lbs. of corn silage and 9,872 lbs. of sunflower silage were produced per acre, and in 1921 the respective yields were 2,800 and 4,400 lbs.

Feeding experiments upon milking cows to illustrate the value of alfalfa hay. H. GOLDSCHMIDT (*K. Vet. og Landbohøjsk. [Copenhagen], Aarskr. 1920, pp. 51-86, figs. 3*).—The results of a third year's experiment to determine the value of alfalfa hay for milk production¹ are given. The composite results have shown that 1 kg. of the alfalfa hay equals about 0.5 fodder unit in feeding value for milk production. Alfalfa hay is recommended to replace from one-third to one-half of the oil cake and roots in the ration, but it was found that replacing all of the oil cake and roots with it resulted in a reduction in milk yield, especially with the high producing cows. An English summary of the work is included.

Feeding experiments upon milking cows to illustrate the value of roots as production fodder. H. GOLDSCHMIDT (*K. Vet. og Landbohøjsk. [Copenhagen], Aarskr. 1921, pp. 17-56, fig. 1*).—This is a discussion of the value of root crops for milk production, based largely on the results of experiments in the feeding of root crops previously referred to (*E. S. R., 34, p. 873*). This experiment and others are summarized, and it is concluded that the value of roots for milk production depends largely on the other feeds in the ration. If sufficient protein is supplied and just enough roots are given for normal production, the feeding of additional roots might increase the fat percentage of

¹ *K. Vet. og Landbohøjsk. [Copenhagen], Aarskr. 1918, pp. 61-89; 1919, pp. 129-160.*

the milk about 0.1 per cent, but from the results of the experiments no further increases in milk flow would be likely to occur. The animals in these experiments to which excess amounts of roots were fed, however, tended to fatten, which might or might not be desirable, depending upon the condition of the animals. An abstract in English is given.

The value of coconut cake, coconut meal, and linseed meal for feeding milch cows, N. HANSSON (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 236 (1922), pp. 26, fig. 1*).—In experiments carried on at two farms by the Swedish Agricultural Experiment Station during the winter of 1921-22, 42 cows were fed comparative rations in which 1.5 kg. of coconut cake or coconut meal was replaced with 1.8 kg. of wheat bran and 0.15 kg. of peanut cake, and in one test 1 kg. of linseed meal was replaced by 1 kg. of ground oats and 1 kg. of wheat bran. The results of the experiments indicated that these feeds are all very satisfactory for dairy cattle. All three feeds were also reported as having increased the amount of milk as well as the fat percentage of the milk. It was estimated that 0.85 kg. of coconut cake and 0.9 kg. of coconut meal containing 3 to 3.5 per cent fat were each equal to one food unit. One kg. of linseed meal was equivalent to 1 kg. of ground oats plus 1 kg. of wheat bran. The paper is summarized in English.

Feeding experiments with urea for milch cows, J. HANSEN (*Landw. Jahrb., 57 (1922), No. 2, pp. 141-190*).—A detailed account is given of a series of 7 experiments carried on from July 26, 1920, to January 25, 1922, to determine the efficiency of urea in replacing high protein feeds or of adding urea to a low protein ration for dairy cattle. The results obtained were studied with regard to the milk and fat produced and the maintenance of weight by the cows. Thirty-three different animals were used in the tests, which included a total of 1,872 cow days during which urea was fed.

The general methods employed in the tests were to divide each experiment into from 3 to 7 periods of from 11 to 14 days each, with transition periods of 7 days between the test periods. The basal rations, which were the same throughout each experiment, were fed in the odd numbered periods and consisted of such feeds as clover or meadow hay, barley or oat straw, beets or dried beet pulp, rape seed cake, soy bean meal, and sunflower meal in amounts determined by the production of the cows. In the even numbered periods the oil meals were left out of the rations, but 200 gm. of urea per head per day plus a sufficient amount of potato flakes or dried beet pulp were added to make this ration agree with the basal ration in starch value. In experiments 5 and 7 exceptions were made to the general procedure, in that experiment 5 was designed to determine the effect of urea feeding for 91 consecutive days, while in the seventh experiment a low protein ration was fed during the first period, 200 gm. of urea per head was added daily to this ration during the second period, and sufficient oil meal to supply an equivalent amount of nitrogen was added to the same ration during the third period. The table below gives a summary of the results of the tests by showing the differences which existed in milk and fat production in the urea periods as compared with the average production during the period just before and just after the urea feeding, during which times the basal ration was fed. The average weights of the animals at the start of the urea feeding period and the gains or losses while on the urea ration are also given.

Results of substituting urea for high protein feeds in the rations of dairy cattle.

Experiment.	Period.	Number of cows.	Length of period.	Average daily milk production during preceding period.	Difference as compared with average of 2 contiguous periods on basal ration.			Average weight.	
					Amount of milk.	Fat.	Amount of fat.	At start of period.	Change during period.
1.....	2	3	Days.	Kg.	Kg.	Per ct.	Gm.	Kg.	Kg.
2.....	2	3	11	8.15	±0	+0.15	+11	536	+5
3.....	2	4	11	11.72	-.95	-.04	-36	539	+4
4.....	2	4	14	12.16	-.53	+.13	-1	552	-4
5.....	4	4	14	12.39	-.24	±0	-8	553	1-17
6.....	6	3	14	13.05	-.88	+.01	-11	535	0
7.....	2	4	14	14.64	+.15	+.12	+23	551	-11
8.....	4	4	14	14.08	+.41	-.05	+7	554	-1
9.....	2	7	91	15.29	-1.10	-.03	-36	554	+17
10.....	2	9	14	13.57	-1.16	+.15	-20	584	-10
11.....	2	0	8	12.65	*+-.51	.....	*+17	530	*-1
12.....	*3	6	12	13.16	*+-.11	.....	*+11	529	*+10

¹ Two cows had digestive disorders during the preceding transition period which apparently influenced their live weight.

² Compared with preceding period only

³ Linseed oil cake was fed instead of urea.

In discussing the results of experiment 5, during which urea was fed continuously for 91 days, the author states that in general urea was not quite as good as the high protein feeds when it was substituted for them, but it maintained a relatively high milk yield and at the same time slightly increased the live weight of the animals. This experiment clearly explained the reduction in live weight which occurred in several of the shorter experiments, since during the first 3 or 4 weeks of this extended test nearly all the cows lost weight but at the end of the test all had gained from 6 to 37 kg. during the 91 days.

The few digestive disorders which occurred during the test seemed to be due to changing the feeds rather than to any bad effect of urea. The author draws attention to the possibility of the practical use of urea in rations low in protein. Detailed results of the nitrogen requirements for milk and maintenance as compared with those supplied in the feeds are given for experiments 6 and 7.

The nitrogenous compounds of a nonprotein nature in feeds, T. PFEIFFER (*Fühling's Landw. Ztg.*, 71 (1922), No. 17-18, pp. 313-324).—Largely on the basis of the results of the above experiments, the author calculates that the cost of urea would be too great for any practical application as a substitute for protein in the ration. He further shows that nonprotein nitrogen in the more common feeding stuffs would be much cheaper and should be made use of. The comparative prices of feeds in June, 1913, and June, 1922, are tabulated at the end of the paper, showing the great increases which have been made in prices during that period.

The mineral requirements of dairy cows, E. B. MEIGS (*Jour. Dairy Sci.*, 6 (1923), No. 1, pp. 46-53).—This is a discussion of the difficulties of keeping dairy cows on positive calcium and phosphorus balances while receiving dry feeds with or without silage. The results of experiments have indicated that the inclusion of alfalfa hay in the ration will be of greater assistance in maintaining positive balances than feeding the animals soluble minerals. Some essential substance for calcium and phosphorus assimilation seems to be present in well cured alfalfa hay or green grass.

Feeding and managing dairy cows in Montana, J. O. TRETSVEN (*Montana Sta. Ctro. 106* (1922), pp. 16, figs. 9).—This consists of a description of the principles of feeding, care, and management of dairy cattle.

The rational feeding of dairy cattle, L. MALPRAUX (*Lait*, 2 (1922), No. 9, pp. 778-786).—The general principles of dairy cattle feeding, based largely on the maintenance and production requirements for protein, energy, and dry matter, are discussed, and sample rations are given.

The relation between skin color and fat production in dairy cows, L. S. PALMER (*Jour. Dairy Sci.*, 6 (1923), No. 1, pp. 83, 84).—From the results of observations by Hooper (*E. S. R.*, 46, p. 373), in which he found no correlation between the amount of color of the body secretions and the yield of milk or fat, the author suggests the possible similarity between these characters and the characters for body pigment and egg production in poultry as previously noted by Palmer and Kempster (*E. S. R.*, 44, p. 69). In the case of the fowls there was found to be a negative correlation between these characters, and if a similar relationship existed the negative correlation would be expected to be greater near the end of the productive (lactation) period.

Studies in the growth and nutrition of dairy calves.—V, Milk as the sole ration for calves, A. C. McCANDLISH (*Jour. Dairy Sci.*, 6 (1923), No. 1, pp. 54-66).—In continuation of the studies of growth and nutrition of dairy calves (*E. S. R.*, 47, p. 781), an experiment is reported to determine the value of milk as the sole diet for calves. Two bulls were given milk from birth until death at 208 and 196 days of age, respectively. Salt, beginning with the seventieth and thirtieth day of age, was the only other food supplied. No water was given. The results show that the animals gained in weight until they were from 2 to 3 months of age, after which slow gains occurred for the next 30 days, followed by losses in weight and finally death. The animals were measured every 30 days for height, depth, and width, which showed very much the same trend as the weights of the animals. After about 3 months of age the animals began to go down on their pasterns, walked with a stiff gait, their hair was rough, and they were unthrifty, finally becoming emaciated, the hair falling out, and body sores occurring. Between 3 and 4 months of age tetanic convulsions occurred from time to time, which continued at irregular intervals as the experiment progressed.

Post-mortem examination of the animals showed that the bones of one calf were soft and flexible, but the bones of the other calf were normal. In both cases the mesenteric lymph gland was enlarged, and the contents of the rumen resembled thin cottage cheese mixed with hair. Both kidneys of one animal were cystic, and in the other animal one kidney was atrophied and the other had enlarged.

Calculations of the food consumption showed that the rations were from 33 to 66 per cent deficient in dry matter during the periods from 3 to 6 months of age. The calves consumed as high as 0.03 lb. of salt per day in some cases, as compared with an average consumption of 0.01 lb. by normally fed calves. The possibility of the excess salt causing convulsions is suggested. An insufficient amount of vitamins B and C in the milk may also have caused the death of the animals. It is evident that milk alone will not supply sufficient nutrients for calves after they are a few weeks old.

Class leaders in agricultural college herds, H. P. DAVIS and R. A. BRAUN (*Jour. Dairy Sci.*, 6 (1923), No. 1, pp. 13-45).—From a questionnaire sent out to 35 agricultural colleges, from which 24 returns were received, the dairy cattle of the Holstein, Jersey, Guernsey, and Ayrshire breeds owned by these agricultural colleges are tabulated as to the best records for each class in each breed.

Fortieth annual report of the Dairymen's Association and of the Dairy School of the Province of Quebec, 1921 (*Dairymen's Assoc. Prov. Quebec, Ann. Rpt.*, 40 (1921), pp. VII+157, fig. 1).—This annual report (*E. S. R.*, 47,

p. 581) consists largely of a number of papers on dairying, included in which are the following: Notes on the Classification of Butter and Cheese, by M. G. Cayer; The Outlook for Dairying, by J. A. Ruddick; Cow Testing Associations, by J. B. Trudel; Preparation of Animals for the Market, by R. Dumaine; A Campaign to promote the Greater Consumption of Milk and Its Products, by J. H. Crepeau; Bookkeeping and Payment of Milk According to Butter-fat Content, by E. Bourbeau; The Future of the Dairy Industry in Canada, by J. H. Grisdale; Milk Under Its Various Forms as a Food, by O. L. Martin; Some Efficient Means to Regulate the Feeding of Cows in Reference to Selection and Milk Yield, by A. Resner; Cooperative Buying and the Dairy Industry, by H. C. Corneillier; The Dairy Industry in Canada during 1921, by J. N. Lemleux; The Ayrshire Breed, by J. L. Tarte; The Dairy Industry in the Province, by G. E. Marquis; and The Adulteration of Condensed Milk, by J. C. Chapais, as well as various addresses which include those of the president, G. Boyer, and of the minister of agriculture, J. E. Caron.

Report of milk survey and ordinance, Kansas City, Mo. (*Kansas City: Common Council, 1921, pp. 412*).—This is a report by C. E. North of a complete survey of the milk supply of Kansas City, Mo., dealing with the amount of milk used, price, cost of production and handling, dairy farm and city inspection, bacterial content, infant mortality, etc. A copy of the ordinance as passed by the Common Council is also included.

The position of dairying in Bavaria, H. PIRNER (*Landw. Jahrb. Bayern, 11 (1921), No. 7-8, pp. 343-393, pls. 5*).—The milk production of Bavaria during the years 1913 to 1920 is reviewed, and data are given showing the milk produced and the prices of milk during each of the intervening years. The value of milk for the development of the coming generation is emphasized, and the importance of giving due consideration to the future milk supply during the period of reconstruction following the war is discussed.

Utilization of buttermilk in the form of condensed and dried buttermilk, O. F. HUNZIKER (*Jour. Dairy Sci., 6 (1923), No. 1, pp. 1-12*).—The utilization of creamery buttermilk in a dried or condensed form for animal feeding is discussed. The few experiments which have been carried on indicate that the food value, digestibility, and vitamin content of the buttermilk have not been materially changed by drying or condensation. The high cost of preparation has been a factor which has prevented a more widespread use of dried and semisolid buttermilk for hog and poultry feeding.

Oidium rubrum, J. PROKS (*Lait, 2 (1922), No. 9, pp. 716-719*).—A rare mold found on cheese, which consists of branching filaments made up of short polygon shaped cells having a reddish tinge, has been named *O. rubrum*. The cultural characteristics of this mold have been worked out on different media, and the results are reported.

Gelatin, the good and the bad, A. D. BURKE (*Ice Cream Rev., 6 (1923), No. 8, pp. 78, 80, 82*).—This is a discussion of the undesirable features of bad gelatin when used in ice-cream making. Suggested methods of testing gelatin for acidity, bacterial content, and color are given, and apparatus is recommended by which the strength, solubility, odor, appearance, and foreign materials may be determined.

VETERINARY MEDICINE.

Veterinary bacteriology, R. E. BUCHANAN and C. MURRAY (*Philadelphia and London: W. B. Saunders Co., 1922, 3. ed., rev., pp. 604, figs. 209*).—This second revision of the work previously noted (*E. S. R., 36, p. 177*) is said by the

authors to give a more adequate discussion of the classification and relationships of microorganisms. The newer conceptions of acidity on the basis of H-ion concentration has received increased emphasis. Several of the chapters on specific pathogenic bacteria have been completely rewritten and others extensively revised.

A compendium of parasitology, E. BRUMPT (*Précis de Parasitologie*. Paris: Masson & Co., 1922, 3. ed., rev. [and enl.], pp. XV+1216, pls. 6, figs. 736).—This is a third revised and enlarged edition of the work previously noted (E. S. R., 31, p. 177).

An indexed system of veterinary treatment: A work on modern medical, surgical, and biological therapy, W. SCOTT (London: Baillière, Tindall & Cox, 1922, pp. XI+636, figs. 195).—This work, the arrangement of which is alphabetical, is a presentation of the present status of knowledge of veterinary therapeutics. An index to the subject matter is included.

Poisonous plants of South Africa, S. M. STENT and H. H. CURSON (*Union So. Africa, Dept. Agr. Buls.* 6 (1922), pp. 8, pls. 2; 7 (1922), pp. 7, pls. 3).—The first of these papers deals with the Transvaal yellow tulip *Homeria pallida*, with the tulip in Cape Province, including *H. collina* and its varieties and *H. elegans*, and with some of the tulip of the genus *Moraea*, which occur in practically every district of the Union. The second paper deals with the Transvaal slangkop *Urginea burkei*, the Natal slangkop *U. macrocentra*, with *U. altissima* and *U. sanguinea*, and the Cape slangkop *Ornithoglossum glaucum*, including their pathological effects.

The development of our conception of immunity, H. A. WOODRUFF (*Australasian Assoc. Adv. Sci. Rpt.*, 15 (1921), pp. 258-285).—A presidential address delivered before the section of veterinary science of the Australasian Association for the Advancement of Science.

The importance of the different vitamins in the immunizing defenses of the organism, M. D'A. BIONDO (*Policlín., Sez. Prat.*, 29 (1922), No. 1, pp. 3-5).—This is a summary of the results of an investigation conducted on pigeons to determine the effect of diets deficient in the various vitamins on the natural immunity of these birds to anthrax. Observations were also noted on the body weight and general condition, the leucocytic count, and the value of the opsonic index of the blood for anthrax bacilli. The pigeons were fed autoclaved polished rice alone (lacking vitamins A, B, and C) and autoclaved rice with additions, respectively, of onion (lacking A and B), butter (lacking B and C), onion and butter (lacking B), and with dried peas (lacking A and C), dried peas and onion (lacking A), and dried peas and butter (lacking C).

The pigeons on all the diets deficient in vitamin B died in from 15 to 24 days with symptoms of polyneuritis, while no morbid symptoms followed the lack of the other vitamins. In the first group there was a loss of immunity to anthrax and a diminution in the opsonic index of the blood.

The detection of blackleg and similar diseases through examination of bone marrow, W. FFEILER and V. GOERTLER (*Arch. Wiss. u. Prakt. Tierheilk.*, 48 (1922), No. 2, pp. 145-149).—The authors are of the opinion that marrow-containing bones are more suitable than pieces of flesh for post-mortem diagnosis of blackleg infection, especially where the material has to be sent a considerable distance. The organism in question can be recovered in pure culture from the bone marrow without danger of contamination from secondary invaders. The metacarpal or metatarsal bones are recommended as the most satisfactory.

Investigations into braxy, S. H. GAIGER (*Jour. Compar. Path. and Ther.*, 35 (1922), Nos. 3, pp. 191-223; 4, pp. 235-256, figs. 3).—The author reports in detail upon investigations of braxy in Scotland commenced in 1918. In the course

of his work 20 cases were found alive, of which 18 were killed for post-mortem examination, one was allowed to die, and a post-mortem examination made at once, and one died and was examined an hour later. The studies have led to the following conclusion as to the nature of braxy:

"Owing to certain circumstances causing debilitation or injury to the mucous lining of the fourth stomach, an anaerobic bacillus is enabled to penetrate through the mucous coat, multiply enormously in the submucosa, and produce a serious tissue lesion. The animal's system immediately starts a counter-attack in self-defense, pouring out phagocytes and exhibiting all the phenomena of an inflammation at the point of invasion. The anaerobic bacilli produce toxins which are absorbed and help to weaken the animal; they extend their point of attack and may attack at other parts of the alimentary canal, for example, the intestine. They penetrate to the peritoneal cavity, and in some cases to the blood stream, when infection becomes generalized. The organs of the body become profoundly affected by the toxemia to a degree varying with their susceptibility to such changes, the kidney ranking first in this respect. The bacterial invasion and the toxemia quickly prove fatal to the animal. An infected animal opened at death shows no putrefactive smell, merely a sour butyric odor and one which is not unpleasant. From the nature of the attack, post-mortem changes occur with great facility, and, should bacteriological work be done upon cases found dead, only conflicting results can be obtained."

The account concludes with a technical description of the braxy bacillus, including its biological characteristics, and a discussion of methods of treatment and prevention.

Report of the departmental committee on foot-and-mouth disease, E. G. PRETYMAN ET AL. (*London: Min. Agr. and Fisheries, 1922, pp. VIII+78*).—This is the report of a committee appointed by the Minister of Agriculture and Fisheries to inquire into the origin and circumstances of the recent outbreak of foot-and-mouth disease and into the policy and procedure which was pursued in dealing with the disease, and to make recommendations as to methods of administrative control, etc. The report includes a summary of the principal recommendations under the headings of precautions against introduction and spreading of disease, procedure in dealing with outbreaks, movement restrictions, disinfection, and administration. In several appendixes accounts are given of foot-and-mouth disease, the history of the disease in Great Britain, the orders made with a view to prevent the introduction of the disease into the country from without, details furnished by the London and North Western Railway Company as to the movements of certain trucks involved in the Leicestershire and Ipswich outbreaks, history of legislation affecting foot-and-mouth disease, rules for foot-and-mouth disease infected places, cases in which outbreaks have occurred on the same premises on two occasions, statistical data on foot-and-mouth disease in 1922, etc.

Foot-and-mouth disease, A. K. MACLACHLAN (*[Gt. Brit.] Min. Health Circ. 306 (1922), pp. 3*).—This is a submittal of the foot-and-mouth disease amendment of 1922 made by the Minister of Agriculture and Fisheries.

Infection and immunity in foot-and-mouth disease, O. WALDMANN and C. TRAUTWEIN (*Centbl. Bakt. [etc.], 1. Abt., Orig., 89 (1922), No. 1-3, pp. 162-166*).—This is a general discussion of the subject, based on the investigations of Waldmann and Pape on experimental foot-and-mouth disease in guinea pigs (*E. S. R., 46, p. 277*).

It has been found that tissue immunity in guinea pigs does not last longer than 4 months, and that in cattle the absolute immunity is probably of not much longer duration. In five animals, which were reinfected from 7 to 8 months after spontaneous infection, generalized infection resulted in four cases,

Blood immunity is thought to last for about one and one-half years. In 80 cases about one-fourth were found to have lost their blood immunity after this length of time and to have become highly sensitive again, while in the remaining animals immune bodies were still present as shown by serum tests with guinea pigs.

On the immune serum against foot-and-mouth disease, S. KURAGANO and T. MOGAMI (*Jour. Japan. Soc. Vet. Sci.*, 1 (1922), No. 2, pp. 101-111).—This Japanese paper is summarized in English as follows:

"Calves subjected to a natural infection proved to be immune against subcutaneous inoculation of virulent blood carried out 20 to 34 days after their recovery. To determine the duration of the immunity produced by the natural infection further investigations are necessary.

"Subcutaneous inoculation of blood, saliva, vesicular content, and emulsion of spleen and lymphatic gland from an infected animal produced the disease in the calves experimented on. The minimum dose of virulent blood for a calf was 2 cc.

"The blood serum taken from the animal recovered from one attack of this disease was found to have a protective action which can be intensified by repeated injections of the virulent blood (100, 500, and 1,000 cc.).

"The period of incubation in this disease is sometimes as short as 24 hours. To test, therefore, the protective action of an immune serum, injection of serum first and of virus one or two days later is preferable to the injection of both at the same time.

"The animals treated with the immune serum in a dose of 0.53 cc. per kilogram body weight proved to be immune against injection of 10 cc. of virulent blood carried out 3 weeks later. To determine the relation between the dose of serum and the duration of immunity further investigations are necessary."

The value of the conglutination and the KH reactions for the serum diagnosis of glanders, K. POPPE (*Centbl. Bakt. [etc.]*, 1. Abt., Orig., 89 (1922), No. 4-5, pp. 29-48, fig. 1).—The literature on the value of the conglutination method for the diagnosis of glanders, as described by Pfeller and Weber (*E. S. R.*, 28, p. 478), and the KH test, as described by Pfeller and Scheffler (*E. S. R.*, 34, p. 276), is reviewed and discussed, and data are presented from the author's experience in the use of both on a large number of animals.

In the case of horses which proved to be free of glanders the conglutination test gave negative results in 93.3 per cent of 2,729 and the KH test negative results in 94.3 per cent of 2,419. Similarly 88.1 per cent of the glandered horses gave positive conglutination and 89.1 per cent positive KH tests. The reliability of both the conglutination and KH tests is, however, considered to be less than that of the complement fixation test, although in 22 cases of glanders positive results were given with the conglutination and KH tests but not with the complement fixation test. It is considered that chronic glanders can be detected with more certainty by the conglomeration, and to a lesser degree by the KH reaction than by the complement fixation test.

Transmission of Rocky Mountain spotted fever by the rabbit tick, *Hæmaphysalis leporis-palustris* Pack., R. R. PARKER (*Amer. Jour. Trop. Med.*, 3 (1923), No. 1, pp. 39-45).—The author reports upon investigations in Montana commenced in 1921 which demonstrate that the rabbit tick (*H. leporis-palustris*) transmits the virus of Rocky Mountain spotted fever from rabbit to rabbit, that infected rabbit ticks occur in nature, and that the infection may be present in eggs deposited by infected females.

The chemistry of tuberculosis, H. G. WELLS, L. M. DEWITT, and E. R. LONE (*Baltimore: Williams and Wilkins Co.*, 1923, pp. VIII+447, figs. 7).—This

volume, which is the outcome of the systematic work on the chemotherapy of tuberculosis which has been carried on in the Otho S. A. Sprague Memorial Institute, Chicago, since 1911, consists of a compilation and critical review of existing knowledge on the chemistry of tuberculosis. The subject matter is considered in three sections, as follows: (1) The Chemistry of Acid-fast Bacteria, by E. R. Long, (2) The Chemical Changes in the Tuberculous Host, by H. G. Wells, and (3) The Chemotherapy of Tuberculosis, by L. M. DeWitt.

Extensive references to the literature are given as footnotes.

Experimental contribution to the question of tuberculin immunity and to the antigenic action of tuberculin, A. WOLFF-EISNER (*Ztschr. Immunitätsf. u. Expt. Ther.*, I, Orig., 35 (1922), No. 3, pp. 215-267, figs. 10).—This is largely a discussion, with reference to the literature and to experimental observations, of the author's theory of the nature of tuberculin, which, briefly summarized, is as follows:

"The poisons of tubercle bacilli are the tuberculins. Tuberculin is not a toxin of the nature of diphtheria or tetanus toxin (1) because it is not primarily toxic, but is a poison of the character of protein poisons (endotoxin), and (2) because the assimilation of tuberculin does not lead to the formation of antitoxins."

Bacillary infection and tuberculosis in man and in animals, A. CALMETTE (*L'Infection Bacillaire et la Tuberculose chez l'Homme et chez les Animaux*. Paris: Masson & Co., 1922, 2. ed., [rev. and enl.], pp. VI+644, pls. 25, figs. 31).—This revised edition of the volume previously noted (*E. S. R.*, 45, p. 181) contains a supplementary chapter on the experimental work which has been done in several laboratories on the chemotherapy of tuberculosis.

A brief account of a disease in cattle simulating hemorrhagic septicemia due to feeding sweet clover, F. W. SCHOFIELD (*Canad. Vet. Rec.*, 3 (1922), No. 2, pp. 74-78).—This is an account of what is thought to be a new disease which occurred almost exclusively among cattle fed on sweet clover hay or clover silage, some of which, at least, had become moldy. It is said that most of the cases investigated can be grouped under one of two heads, namely, (1) the hemorrhagic type, with the presence of subcutaneous swellings, and (2) the anemic type, where the animals have died following an operation such as dehorning or where death has resulted apart from any such contributory cause.

Investigations on the immunology of swine plague, R. R. BIRCH and J. W. BENNER (*Jour. Amer. Vet. Med. Assoc.*, 62 (1922), No. 2, pp. 148-161).—This paper summarizes the results of previous investigations on the etiology and immunology of swine plague, and reports the results of further attempts to secure immunity against the disease.

In the first experiment two litters of pigs 6 weeks of age were used, one consisting of 7, averaging from 15 to 20 lbs. in weight, and the other of 5, averaging from 25 to 30 lbs. Of these 1 received an intravenous injection of 1 cc. of a suspension of *Bacterium suisepiticum* and died two days later, while 5 received subcutaneous injections of 1 or 2 cc. of the suspension, a week later a second injection in larger amounts, and 11 days later an intravenous injection of 1 cc. The intravenous injection was followed by general stiffness of varying intensity, but no deaths occurred. Of the remaining animals which were left as controls, 2 were given an intravenous injection, which resulted in death within 64 hours in one case and in permanent disability in the other.

The animals which recovered from the effect of the first intravenous injection were then given a 2-cc. intravenous injection, and one of the controls of the first experiment also received the same injection. The reactions to this injection showed that in the smaller pigs the degree of immunity established was in almost direct proportion to the quantity received in previous treatments,

while in the larger animals this was not true. Moreover, the animal which had received no preliminary injection stood the intravenous injection better than those which had been treated previously. Twenty days later this animal, another which had received no treatment, and one from each group which had received two subcutaneous and two intravenous injections were injected intravenously with 3 cc. of the suspension. The one which had received no previous treatment died in 5 hours, the one which had received a single intravenous injection gave a slight reaction but recovered completely in about 2 weeks, and of the other two, the one from the group of smaller animals died in 20 hours and from the larger collapsed, but recovered after a long interval.

The sera of the various animals which had survived all treatments were tested for immune bodies by injection into rabbits, followed later by injection of the organism in dilution. Agglutination tests were also made on the sera. Normal hog serum and antihog-cholera serum were also used in these tests to test the theory that as hogs advance in age they acquire an immunity to the swine plague organism. In the rabbit tests all the animals died in from 16½ to 138 hours. The time interval before death showed that the blood from the hyperimmunized animals had decidedly greater protective power than normal or hog-cholera serum, and that the latter had a very slight protective power.

Further attempts were made to hyperimmunize hogs against both cholera and swine plague, but with rather unsatisfactory results. The general conclusion drawn from these studies is that subcutaneous injections of the virulent organism will produce only an uncertain immunity and at the risk of killing, disabling, or stunting the pigs which are to be protected. Consequently, there is at present no useful place for swine plague vaccines and bacterins.

A species of roundworm (*Gongylonema*) from domestic swine in the United States, E. A. CHAPIN (*U. S. Natl. Mus. Proc.*, 62 (1922), Art. 10, pp. 3, figs. 3).—The author presents a description of *G. ransomi* Chpn. from East St. Louis, Ill., which burrows in the mucosa of the tongue and esophagus of swine.

Combined carbon-dioxid content of blood plasma in the horse, N. IJICHI (*Jour. Japan. Soc. Vet. Sci.*, 1 (1922), No. 2, pp. 67-79; also in *Jour. Amer. Vet. Med. Assoc.*, 62 (1922), No. 1, pp. 74-76).—In this paper, presented at the annual meeting of the Japanese Society of Veterinary Science at Tokyo, in April, 1922, the results obtained in experiments conducted during a period of three years are reported.

It was found in experiments with 30 military horses that the carbon-dioxid content of blood plasma varies from 72.1 to 52.8 volume per cent, with an average of 62.6 volume per cent. The account includes data on the carbon-dioxid content of blood plasma (1) in the normal horse, (2) in the horse under abnormal conditions, including (a) fatigue and (b) podophyllitis, colic, influenza, pectoralls, and morbus maculosus, (3) when affected with chlorin and phosgene gas poisoning, (4) with a decrease in the carbon-dioxid content in the case of experimental acidosis, (5) with limited feeding, and (6) with carbon-dioxid intoxication.

Control of bacillary white diarrhea, 1921-22, G. E. GAGE and O. S. FLINT (*Massachusetts Sta. Control Ser. Bul.* 22 (1922), pp. 3-8).—Following a brief preliminary account of the nature of *Bacterium pullorum* infection, the authors report on the service rendered under the poultry disease elimination law for the season ended August 31, 1922, in tabular form, under the headings (1) geographical distribution of the various breeds tested during 1921-22, (2) geographical distribution of the infection as determined by the 1921-22 testing

work, (3) distribution of infection among various breeds, (4) classification of the sizes of flocks tested, (5) number of flocks having certain limits of infection, and (6) reduction of percentage infection as determined by testing work on 18 different flocks, 1919-1921.

It is shown that the number of cases of bacillary white diarrhea is being reduced each year, and that there are indications of improvement among the breeding flocks as a result of the testing work. Of the 110 flocks tested during the year, 27 were found to be free from the disease. While it is not easy to rid flocks of this disease, especially if the original infection is great, it appears that the infection may be eliminated by testing the original birds, the progeny, and the progeny of the progeny, this being possible only after a series of tests. The authors present three plans for testing and elimination of the disease, any one of which may be adopted by cooperating poultrymen. The first of these consists of tests on birds one year of age or older, the second of tests on pullets, and the third of an alternate plan for tests on pullets.

A study in active immunization against fowl cholera. K. SAKAMOTO (*Jour. Japan. Soc. Vet. Sci.*, 1 (1922), No. 3, pp. 151-155).—In this study of the antigenic properties of various vaccines for fowl cholera, pigeons were inoculated subcutaneously in the breast with the various preparations to be tested and two weeks later were inoculated with a minimal lethal dose of a virulent culture of the fowl cholera organism.

Unsatisfactory results were obtained with the fowl cholera organisms attenuated by incubation at from 42 to 43° C., or killed by shaking for 24 hours in physiological salt solution, or by drying in a desiccator for 40 days, or by heating in a water bath for 1 hour at 60°. Protection was secured with a suspension of the organism treated with iodine or glycerin, with an 11-day broth culture of the organism condensed to one-tenth its original volume in vacuo at from 45 to 50°, and with the aggressin obtained from the pleural exudate of a rabbit dead from an intraperitoneal injection of a small dose of the culture. This exudate was heated for 3 hours at 44°, passed through a Berkfeld filter, and preserved with 0.5 per cent phenol. After 24 hours 7 pigeons were inoculated with doses of from 0.1 to 1 cc. Those receiving 0.5 cc. or more were protected from a minimal lethal dose of the virulent organism.

A polyvalent vaccine prepared from the heated cultures of four organisms of the hemorrhagic septicemia group (fowl, rabbit, swine, and guinea pig) exerted an even greater protective action than the fowl cholera organism itself.

A disadvantage noted in the above methods is the formation of abscesses at the point of inoculation. To avoid this a 48-hour growth of the culture on agar was treated with 1 per cent potassium hydroxide and allowed to stand for 48 hours at room temperature. On neutralizing this with a 1 per cent solution of acetic acid a white precipitate formed which was centrifuged, washed five times with water, and finally dissolved in 1 per cent sodium carbonate. This preparation gave very satisfactory results as an immunizing agent and with no local disturbances at the site of injection.

Detection and control of avian tuberculosis with tuberculin. G. EGGE (*Arch. Wiss. u. Prakt. Tierheilk.*, 47 (1921), No. 3, pp. 175-197).—The results are reported of the application of the tuberculin test to a large number of fowls. Three kinds of tuberculin were used, avian tuberculin, a commercial preparation called phymatin, and old-tuberculin (Koch). The method of application was the intracutaneous method of Moussu and Mantoux (*E. S. R.*, 21, p. 582) as used by Van Es and Schalk (*E. S. R.*, 31, p. 582). In all 966 fowls in 22 flocks were tested with one or more of the tuberculin, and the positive reactors were killed and examined for tuberculous lesions. Several

nonreacting birds which presented some evidence of tuberculosis were also killed and examined.

Of 941 fowls tested with avian tuberculin 93, of 496 tested with phymatin 37, and of 193 tested with old-tuberculin 17 gave positive reactions. All of the positive reactors showed evidence of tuberculosis on post-mortem examination. Among those in the first group tested with avian tuberculin were 7 which gave a negative test but later with phymatin or old-tuberculin reacted positively, and 5 which gave a negative reaction with all three but were emaciated and soon after showed marked symptoms of tuberculosis. Similarly in the other two groups were found 28 of the phymatin and 9 of the old-tuberculin groups which gave negative reactions although tuberculous.

It is concluded that the tuberculin test, especially with avian tuberculin, is of great practical value in detecting avian tuberculosis, but that it is of advantage to repeat the test with negative or doubtful reactors.

Recommendations concerning the common diseases and parasites of poultry in California, J. R. BEACH and S. B. FREEBORN (*California Sta. Circ. 251 (1922)*, pp. 44, figs. 34).—This consists of brief discussions of control measures for the more important diseases and parasites of poultry, including chicken pox and canker or avian diphtheria, colds and roup, nutritional disease resembling roup, fowl cholera associated with ruptured egg yolks, tuberculosis, coccidiosis, white diarrhea of chicks, leg weakness of chicks, blackhead in turkeys, common diseases of birds, lice, mites, ticks, fleas, flies, tapeworms, roundworms, and cecum worms.

RURAL ENGINEERING.

Water-holding capacity of irrigated soils, O. W. ISRAELSEN and F. L. WEST (*Utah Sta. Bul. 183 (1922)*, pp. 3-24, figs. 7).—Studies on the capacity of soils in the natural field condition to absorb and retain irrigation water are reported. A review of water capacity measurements made by 10 investigators in 8 States and on 20 different classes of soil is presented, showing that the amount of water absorbed by the soil when in need of irrigation varied from 0.5 in. of water to 1 ft. of sand soil to 2.25 in. of water to 1 ft. of clay loam soil.

The experimental work was conducted on uncropped plats to which excessive amounts of water were applied, thus assuring complete capillary saturation. It was found that one day after irrigation the plat which received 36 in. of water held $\frac{1}{2}$ in. more per foot of soil than the plat which was given 12 in., and that the plat receiving 24 in. held 0.25 in. more water per foot of soil than the 12-in. plat. Ten days after the heavy irrigations were applied each of the plats held the same amount of available water, about 1.5 in. per foot in the upper 6 ft.

These results are taken to indicate that as a general rule soils have the capacity to absorb from 0.5 to 1.5 in. of water to each foot of depth of soil that needs moistening, and that the actual capacity of a given soil depends upon its texture and structure. Sandy or gravelly soils retain the smaller amounts and clay loam soils the larger amounts.

Diagram for designing open ditches with 1 : 1 side slopes, F. T. MEWES (*Engin. News-Rec.*, 90 (1923), No. 4, p. 173, fig. 1).—Graphic data are presented on the velocity of flow and discharge of open ditches, which include a logarithmic diagram to determine the hydraulic radius and cross-sectional area of ditch for a given bottom width and depth of flow, and a nomographic diagram to determine the velocity of flow for a given hydraulic radius, hydraulic slope, and roughness coefficient n . The latter diagram is based on Manning's formula

for velocity, in which the roughness coefficient n is equal to Kutter's n . The diagram is arranged for a value of n of 0.035.

Porto Rican irrigation project has novel features, R. A. GONZALES (*Engin. News-Rec.*, 90 (1923), No. 4, pp. 161-164, figs. 3).—This is a brief description of the more important features of an irrigation project on the island of Porto Rico which will irrigate 15,000 acres of land on the high rolling plain on the northwest coast. Despite the numerous sink holes on the site of the storage reservoir required, it has been found that these can be sealed with clay. Hauled-in material for a high earth dam is to be sluiced into place.

Administration report on irrigation branch for the year 1920-21, S. G. RIVETT-CARNAC (*Cent. Provs. and Berar [India], Irrig. Branch Admin. Rpt. 1920-21*, pp. [165], pls. 3).—The operations of the irrigation branch of the Public Works Department of the Central Provinces and Berar, India, for the fiscal year 1920-21 are described in this report.

Report on investigations into the improvement of river discharge measurements, II, E. B. H. WADE (*Egypt Min. Pub. Works, Phys. Dept. Paper 6* (1922), pp. 12, pls. 14).—In a second report on the subject (*E. S. R.*, 46, p. 886), it is shown that when the velocity of a stream is very low its measurement presents special difficulties. There is, therefore, a demand for an improved type of current meter to deal with the case of sluggish flow. A type of current meter for this purpose is described, in which a helix is driven by an independent constant power and the effect of the stream is merely to increase or decrease the rate of the helix by an amount which serves as a measure of the velocity of the stream. Data are presented showing the advantage of using an independent constant power in this manner.

Surface water supply of Snake River Basin, 1918 (*U. S. Geol. Survey Water-Supply Paper 483* (1922), pp. V+171, pls. 2).—This report, prepared in cooperation with the States of Oregon, Nevada, and Washington, presents the results of measurements of flow made on streams in the Snake River and tributary basins during the year ended September 30, 1918.

Water powers of the Cascade Range.—IV, Wenatchee and Entiat Basins, G. L. PARKER and L. LEE (*U. S. Geol. Survey Water-Supply Paper 486* (1922), pp. IV+76, pls. 14, figs. 3).—This report, prepared in cooperation with the Washington State Board of Geological Survey, describes the Wenatchee and Entiat Basins in central Washington, with particular reference to their value as potential sources of water power. Data on which the report is based consist of daily stream flow records, miscellaneous measurements, river plans and profiles, and other survey data, continuing previous work (*E. S. R.*, 34, p. 884).

Surface water supply of western Gulf of Mexico basins, 1919-1920 (*U. S. Geol. Survey Water-Supply Paper 508* (1922), pp. IV+136, pls. 2).—This report, prepared in cooperation with the State of Texas, presents measurements of flow made on streams in the Trinity, Brazos, Colorado, Guadalupe, San Antonio, Nueces, and Rio Grande River Basins during the biennium ended September 30, 1920.

Twenty-first annual report of the Reclamation Service ([*U. S.*] *Reclam. Serv. Ann. Rpt.*, 21 (1922), pp. II+174, fig. 1).—This report not only covers the operations of the U. S. Reclamation Service for the fiscal year 1921-22 but reviews the operations under the national reclamation act during the 20 years since its approval. It is stated that the investment in construction during that period has been in round numbers \$135,000,000, of which about \$13,000,000 has been repaid. This investment has accomplished the construction of works by which about 1,675,000 acres have been furnished with a complete water supply, and about 1,100,000 additional acres have been furnished a supplemental

supply under the provisions of the Warren Act. On the Government projects proper the area given comprises 31,462 farms, or an average area per farm of about 53 acres.

With the investment mentioned, the service has excavated over 200,000,000 cu. yds. of earth and rock, of which about 14,000,000 yards have been placed in dams, and canals have been built aggregating over 13,000 miles in length, including 27 miles of tunnels and 135 miles of flumes.

Plane table manual, D. B. WAINWRIGHT (*U. S. Coast and Geod. Survey Spec. Pub. 85 (1922)*), pp. VI+96, pls. 8, figs. 41).—This is a manual of information on topographic surveying by means of the plane table.

An impact test for gravel, F. H. JACKSON (*Amer. Soc. Testing Materials Proc.*, 22 (1922), pt. 2, pp. 362-367, figs. 2).—In a contribution from the U. S. D. A. Bureau of Public Roads, an impact test for gravel is described.

The apparatus used consists essentially of two 2.5-in. steel balls, the lower ball fastened rigidly to a cast-iron anvil measuring 5 in. in diameter by 1.75 in. high and the upper one free to fall between three $\frac{3}{8}$ -in. guide rods. An adjustable stop, provided with a clamping nut, slides on one of the guide rods. Fastened rigidly to the upper ball is a $\frac{3}{8}$ -in. rod graduated in inches, which passes through a hole in the stop. The hammer, consisting of the upper ball and the graduated rod, weighs exactly 1,200 gm. while the remainder of the apparatus weighs exactly 6 kg. so that the ratio of the weight of the hammer to the weight of the anvil is 1:5.

The fragment to be tested is held firmly on the lower ball so that its smallest diameter is vertical. The upper ball is allowed to rest on the test specimen, and the stop is adjusted and clamped at the height of the fall desired, measured in inches directly on the rod. The upper ball is then raised until it comes into contact with the stop, and allowed to fall upon the specimen until a height is reached at which fracture occurs.

Tests of the apparatus on different samples of gravel seem to indicate that for a material of uniform quality a fairly definite relation exists between the height of fall and the diameter of the particle.

Preliminary impact studies—Skunk River bridge on the Lincoln Highway near Ames, Iowa, A. H. FULLER (*Iowa Engin. Expt. Sta. Bul. 63 (1922)*), pp. 31, figs. 8).—This is a report of preliminary studies conducted under a cooperative agreement between the U. S. Department of Agriculture, the Iowa State Highway Commission, and the Engineering Experiment Station of the Iowa State College, the object of which was primarily to investigate the effect of impact of trucks and tractors upon a 150-ft. span, 20-ft. roadway through-riveted steel highway bridge with a 6-in. concrete floor on steel stringers. The preliminary work comprised studies of the distribution of stress throughout various members and portions of members and the comparison of a number of different instruments to determine which ones would be the most suitable for future work. Two trucks and a caterpillar tractor were used as loads.

The results of about 200 observations condensed from 2,500 field observations are presented in this report. Owing to its preliminary nature no definite conclusions are drawn.

Physical properties of subgrade materials, J. R. BOYD (*Amer. Soc. Testing Materials Proc.*, 22 (1922), pt. 2, pp. 337-355, figs. 15).—This is a report of further studies by the U. S. D. A. Bureau of Public Roads on tests for determining the physical properties of road subgrade materials (*E. S. R.*, 45, p. 587).

The results indicate at least three important factors upon which the physical properties of subgrade soils depend, namely, the gradation, which is expressed by the mechanical ratio, the moisture content, which is expressed by the moisture index, and the character of the soil, which is expressed by the ab-

sorption number. When the clay content of the soil is increased, its ability to take up and retain moisture and its percentage volume change have been found to be increased. The character of the soil influences its percentage volume change, as is evidenced by the fact that for increasing adsorption numbers the percentage volume change increases. When the moisture index of the soil is less than unity the bearing value will be high, and when it is above unity high bearing values can be obtained, provided the adsorption of the soil is high.

Economic grades save most gasoline, C. LEWELLEN (*Iowa Engineer*, 23 (1923), No. 4, pp. 7-9, figs. 3).—A description of the testing apparatus used in studies of the relation between highway grades and the consumption of fuel by motor vehicles, conducted by the Engineering Experiment Station of Iowa State College, is given in this report. These experiments have indicated that the average gasoline consumption in gallons per 1,000 ton miles is smaller for a round trip with the motor declutched on down grades than it is for a round trip with the clutch engaged over the entire course.

Economic theory of highway grades, T. R. AGG (*Engin. News-Rec.*, 90 (1923), No. 2, pp. 76-79, figs. 7).—This is a more detailed report of studies, some of the results of which are presented in the above. It has been found that momentum grades on rural highways are economical both from the standpoint of fuel and time, and that under certain circumstances less fuel will be required on a road with an undulating grade line than on one with very flat grades.

Road grading costs reduced by tractor hauling, E. R. WIGGINS (*Engin. News-Rec.*, 90 (1923), No. 5, pp. 200, 201, figs. 3).—The costs for plant investment and operation on two heavy road grading operations in Iowa and Missouri are itemized. In this work a comparison was made of tractor-operated elevating graders and tractor-hauled 4-wheeled scrapers. No conclusions are drawn.

Caustic magnesia cement (*U. S. Dept. Com., Bur. Standards Circ. 135* (1922), pp. 14).—A brief summary is given of the discovery, early history, and later application of the reaction of caustic magnesia with solutions of magnesium chlorid, resulting in the production of a quick-hardening cement. Short descriptions are given of the ore used and of methods of calcining the ore. Formulas are also suggested for several types of products, together with information on the development of specifications.

The fuel value of wood, I. T. BODE (*Iowa Agr. Col. Ext. Bul. 111* (1922), pp. 4).—Data on the relative fuel values of different Iowa woods under different conditions of seasoning are briefly presented.

It is stated that important factors which influence the heating value of wood are the species, the part of the tree from which the wood comes, the seasoning, and the method of burning. The most efficient wood fuel is that which has been the most thoroughly seasoned. The heartwood of the tree is said to be better than the sapwood for fuel. Generally the softwoods burn more quickly than the hardwoods, and the lighter hardwoods burn more quickly than the heavier hardwoods. Pines give a quicker, hotter fire than birch but are consumed more quickly. Birch gives a more intense flame than oak, but the oak gives a steadier heat.

Longer durability for fence posts and farm timbers, I. T. BODE (*Iowa Agr. Col. Ext. Bul. 109* (1922), pp. 16, figs. 12).—Practical information on the creosoting of fence posts and other farm timbers, with particular reference to conditions in the State of Iowa, is presented in this bulletin. The information is based on experiments at the Iowa Experiment Station in which it has been found possible to increase the life of ordinary woods such as cottonwood, willow,

and soft maple to 20 years or more. Creosote has been applied either by the brush or hot spray method or by the open-tank immersion method.

It has been found that for fence posts the brush treatment, while slightly beneficial, is not thorough enough to insure very complete protection against decay, and the conclusion is drawn that the life of softwoods is increased hardly enough by this treatment to pay for the trouble.

Protective metallic coatings for the rustproofing of iron and steel (*U. S. Dept. Com., Bur. Standards Circ. 80, 2. ed. (1922), pp. 34, pls. 12, figs. 5*).—This publication discusses the nature of corrosion of iron and steel and the principles underlying methods of prevention of corrosion. Types of coatings and methods of application are described, microstructure is discussed, and information is given on the preparation of the surface before coating and the accompanying effects upon the mechanical properties of the steel. Methods of testing coatings are also described.

It is recommended that zinc coatings be given preference over all others when the object of the coating is protection against corrosion only. For general use on large, smooth surfaces, sheets, rods, wires, pipes, etc., the hot-dipped zinc coatings are entirely satisfactory, although some of the other processes are more economical in the amount of zinc used. Too heavy coatings of the hot-dipped type should not be used on articles which must be sharply bent or shaped on account of the tendency of the coating to flake off at such points. One ounce of zinc per square foot of surface exposed is considered to be satisfactory for most purposes, but less may be sufficient if evenly distributed.

The hot-dipped and sherardized zinc coatings are not recommended for hardened and tempered steels. The plated zinc and the sherardized coatings are both recommended for accurately machined parts, and so-called spray coatings are considered to be valuable for large or complex parts which must be coated in place or after assembling.

Nothing is said to be gained from the standpoint of resistance to corrosion by first coating an article with copper or a similar metal and then finishing with zinc. Black nickel may be used to provide a black finish for a zinc coating. The use of oil and like substances on any type of coating is strongly recommended. It is stated that the life of zinc coatings, particularly those of a porous nature, may be prolonged almost indefinitely by periodic oiling.

The time required for the appearance of rust on zinc-coated articles when exposed to salt spray may in general be taken as an indication of whether or not the coating is satisfactory for outdoor exposure. A period of 24 hours is considered to be unsatisfactory, from 48 to 72 hours satisfactory for mild exposure, and from 96 to 144 hours satisfactory for severe exposure.

Paint, varnish, turpentine, and linseed oil laws in existence August 1, 1922 (*Philadelphia: G. B. Heckel, 1922, pp. 94*).—This pamphlet, issued under the authority of the central committee of the National Paint, Oil, and Varnish Association, the Paint Manufacturers' Association of the United States, the National Varnish Manufacturers' Association, and the Dry Color Manufacturers' Association, by G. B. Heckel, secretary, contains the texts of the laws of the different States regulating the manufacture and sale of paints, varnishes, and oils, and constituent materials.

California, Colorado, Georgia, Iowa, Massachusetts, Minnesota, Mississippi, Nebraska, North Dakota, Ohio, Pennsylvania, South Dakota, Vermont, Virginia, Wisconsin, and Wyoming have statutes in force regulating the sale of paints.

Practical polishing and staining, A. W. PARKHOUSE (*London: Benn Bros., Ltd., 1922, pp. VIII+120, figs. 3*).—Practical information on polishing and staining woods is presented in this publication. Chapters are included on

preparation of the wood, staining and filling the grain, preliminary stages of polishing, bodying-in, matching up the color, the finishing stage, the dull egg-shell finish, fuming and waxing oak, stains and staining, varnishing, faults and their remedies from the dealer's point of view, staining of wicker goods, the components of various polishes and stains and purity tests, the treatment of decorated furniture, and the polishing of floors.

Vaporization of motor fuels, P. S. TICE (*Jour. Soc. Automotive Engin.*, 11 (1922), No. 4, pp. 307-319, 322, figs. 7).—The purpose of this paper is to summarize the conditions surrounding and controlling fuel vaporization in the cycle of operation of a throttle-controlled internal-combustion engine, fitted with an intake-manifold and a carbureter. In this connection a brief and purely qualitative treatment of the characteristics of a vapor is given, and the necessity for vaporizing a liquid fuel before attempting to burn it, the separate effects of the conditions that control vaporization, and the heat balance of vaporization are discussed. The conclusion is reached from the discussion and from actual demonstrations that it is well to depend as little as possible upon the cylinder heat and temperature to complete the vaporization of the fuel.

The comparative merits of benzol and gasoline as engine fuels, W. O. HINCKLEY (*Jour. Soc. Automotive Engin.*, 11 (1922), No. 4, pp. 359-362, fig. 1).—The process of manufacturing benzol is described, and specifications for motor benzol are presented. Comparative data in regard to end point, heat value, and vapor tension for motor benzol and gasoline are presented, together with a description of comparative engine tests. The results for a fleet of vehicles were about 10 per cent in favor of motor benzol over gasoline.

Reclamation of used petroleum lubricating oils, W. H. HERSCHEL and A. H. ANDERSON (*U. S. Dept. Com., Bur. Standards Technol. Paper 223* (1922), pp. 93-108).—This publication discusses the reclamation of lubricating oils, particularly those used in the lubrication of internal-combustion motors, and describes different methods at present available for such reclamation. Tests of certain methods are described.

The conclusion is reached that used oils should be judged by the same tests as are applied to new oils, and that the present methods of reclaiming oils are successful in so far as the generally recognized tests are concerned. Improvements are said to be limited by a lack of knowledge concerning what additional tests are needed to make sure that oils, whether new or reclaimed, possess those properties which make them suitable when new and durable in use. Further investigation is said to be especially needed concerning the value of the tests for acidity, sulphur, and resistance to oxidation.

Notes on motor trucks, C. T. MYERS (*Jour. Soc. Automotive Engin.*, 11 (1922), No. 4, pp. 333-345, figs. 12).—An outline is given of some of the reasons why certain weight reductions in motor trucks are misleading and difficult to effect. The use of aluminum to effect weight reduction is commented upon, and the various advantages claimed for metal wheels are discussed. It is pointed out that, while these claims may be true, they are unsupported by reliable data. A series of tests of over a year's duration to determine the relative merits of wood and metal wheels are described. Four trucks each equipped with wood and metal wheels on diagonal corners to secure an equalization of conditions, were employed.

It was found that the average wear of the tires mounted on metal wheels was about 13 per cent greater than that of those mounted on wood wheels. The question of unsprung weight is discussed, as is also the importance of reducing chassis and body weights to a minimum. It is pointed out, however, that a reduction in these weights does not necessarily mean a resulting saving

in the gasoline consumption or the tire expense. Lubrication is also discussed, and the superiority of oil over grease as a chassis lubricant is emphasized.

What tractors and horses do on Corn Belt farms, L. A. REYNOLDS and H. R. TOLLEY (*U. S. Dept. Agr., Farmers' Bul. 1295 (1923), pp. 11+14, figs. 9*).—This is the first of a series prepared under the direction of the committee on farm power, appointed by the Secretary of Agriculture, to represent the Bureaus of Agricultural Economics, Public Roads, and Animal Industry. It discusses the relative adaptability of tractors and horses to work on Corn Belt farms under both favorable and unfavorable conditions, their relative reliability, and the choice of power for specific farm operations.

Changes effected by tractors on Corn Belt farms, L. A. REYNOLDS and H. R. TOLLEY (*U. S. Dept. Agr., Farmers' Bul. 1296 (1922), pp. 11+12, figs. 4*).—This bulletin is No. 2 of the series noted in the above. Its purpose is to show how tractors have been responsible for changes on the Corn Belt farms where they are owned and the possibilities of reducing man labor and work stock. Changes which may occur in the cropping system, size of fields, and live stock enterprises are also pointed out.

The lighting of grain elevators, W. H. RADEMACHER and E. L. DEE (*Amer. Elevator and Grain Trade*, 41 (1922), No. 6, pp. 402, 403, figs. 4).—Recommendations on the efficient lighting of grain elevators, based upon a comprehensive survey of typical elevators, are presented in this article. Attention is especially drawn to the difficulty interposed by the exceptional dustiness in grain elevators and flour mills.

Comparative tests of roof ventilators, F. B. ROWLEY (*Jour. Amer. Soc. Heating and Ventilating Engin.*, 29 (1923), No. 1, pp. 9-13, figs. 13).—Tests of five distinctive types of roof ventilator, conducted at the University of Minnesota, are reported together with a description of the method and apparatus used. The ventilators were all 10 in. in diameter. The wind velocity was produced by a fan discharging through a 36-in. circular duct. The ventilators were placed 3 ft. 10 in. in front of the outlet and in such a position that the center line of the head was as near as possible in the center line of the duct.

The best results were obtained by a so-called rotary siphoning type of ventilator, closely followed by a so-called plane stationary type. It is thought to be impossible to expect uniform results from ventilators of the same class, but that ventilators even though similar will give entirely different results depending upon the dimensions and proportions.

Humidity requirements for residences, A. P. KRATZ (*Jour. Amer. Soc. Heating and Ventilating Engin.*, 29 (1923), No. 1, pp. 14-18, figs. 5).—In a contribution from the University of Illinois, data are presented on humidity requirements for artificially heated residences. These indicate that a room at 69° F. will be comfortable if the relative humidity is maintained at a value of from 35 to 45 per cent. A relative humidity of about 40 per cent is considered to be as high as it is practical to maintain in residences. If the humidity is much higher than this the condensation on the windows will be excessive unless double windows are used.

Data on the amount of water in gallons per hour required to humidify 10,000 cu. ft. of space are also presented.

Water supply installations for farmsteads and country estates, W. P. GERHARD (*New York: Author, 1922, pp. 24*).—Practical information on water supply installations for farmsteads and country homes is presented in this report.

Purification of sewage effluent by clay, A. A. BADO and T. J. RUMI (*An. Soc. Quim. Argentina*, 8 (1920), No. 36, pp. 132-137).—Preliminary studies on

the purifying action of loess silt from the pampas on sewage effluent are briefly reported.

It was found that the loess silt had a marked influence in reducing the putrescibility of sewage effluent. The reduction of organic matter by treatment with loess increased with the time of contact up to 4 hours, with the amount of loess used up to 50 per cent, and with the degree of pulverization of the loess. It is concluded that the influence of the loess is mainly over the putrefactive bacteria.

RURAL ECONOMICS AND SOCIOLOGY.

An economic study of the production of canning crops in New York, L. J. NORTON (*New York Cornell Sta. Bul. 412 (1922), pp. 5-82, figs. 6*).—This investigation was conducted to obtain basic information regarding the production and cost of production of the principal crops grown in New York for canning factories and to study some of the factors influencing them. The data on cost of production were collected by the survey and the accounting methods. Cost data on peas for canning were obtained in Orleans; Genesee and Monroe; Steuben, Ontario, and Livingston; and other counties. Those on tomatoes were secured in Orleans, Niagara, Chautauqua, and Erie counties.

Tabulations are made of cost items, returns per acre, variations in the cost of production, labor requirements, and factors affecting costs. Comparisons are made with costs in other States. The following table summarizes some of the data presented:

Summary of some of the costs of growing canning crops in New York in 1920.

Kind of crop.	Number of farms.	Total growing cost per acre.		Total harvesting cost per acre.		Total cost per ton	Price received per ton.
			Per cent.		Per cent.		
Peas.....	262	\$53.72	74.5	\$18.42	25.5	\$61.81	\$80.44
Tomatoes.....	133	105.39	64.0	59.20	36.0	18.88	21.29
Sweet corn (Livingston area).....	13	43.31	78.9	11.55	21.1	16.85	20.07
Sweet corn (Ontario area).....	12	50.50	75.7	16.19	24.3	16.25	23.27
Sweet corn (Orleans area).....	9	46.82	81.7	10.52	18.3	26.85	25.00
String beans.....	3	57.91	96.1	2.34	3.9	49.55	40.00
Lima beans.....	4	53.19	77.6	15.34	22.4	106.25	120.00

Outlines of land economics, R. T. ELY, M. L. SHINE, and G. S. WEHRWEIN (*Ann Arbor, Mich.: Edwards Bros., 1922, vols. 1, pp. IV+150, figs. 3; 2, pp. 163, figs. 5; 3, pp. III+172, figs. 6*).—This is a series of three volumes, presented in mimeographed form anticipating possible revision and combination.

I. *Characteristics and classification of land*.—As here defined, "land economics is that division of economics, theoretical and applied, which is concerned with the land as an economic concept and with the economic relations which grow out of land as property." The point of view of distribution is taken and then connected with production, considering particularly the reactions of distribution on production and in some cases of production on distribution.

The chapter headings are land economics defined and described, property defined and described—the significance of property relations for distribution and for production, the legal and economic characteristics of land, the characteristics of capital contrasted with the characteristics of land, land classification, land utilization, possibilities of increasing the economic land supply, agricultural land, range and ranch land, forest land, mineral land, water rights, urban land, and highways and public utility land.

II. Costs and income in land utilization.—This volume consists of an extensive compilation of material relating to the concept of rent or income from land, arranged in 12 chapters, namely, introductory—discussion of the term rent; rent and surplus; the emerging costs in land utilization; the margins of production; elements in land income; some errors that have been involved in the theory of rent; rent and value; rent and the various kinds of land; urban rents; water rents and public utility land rents; rents as determined by custom, competition, and public authority; and the socialization of rent. Appendixes are included which treat Land Values in New York City, by G. B. L. Arner; Luck and Chance in Success and Failure, by Ely; and The Effect of Improvements on the Margins of Utilization of Land, by W. E. Grimes.

In a summary of the chapter on the elements in land income, it is set forth that the income from lands tends to be kept equal to other incomes by the shifting of margins all over the economic field, but it tends to be less than the returns to fluid capital because of the competition for landownership. Unusually high returns occur through conjuncture, and should be called conjunctural surplus rather than land income. Land income is not equal to the total differential known as the economic rent, for this differential is distributed. Elements that have been neglected in the analysis of land incomes are area, which is a factor notwithstanding denials, and the amenities or psychic returns from land. Finally, land income is due to the relative and limited bounty of nature.

III. Land policies.—Land policies are incidentally included in the volumes noted above, but certain special topics are given particular development here, as land settlement and home ownership—a general survey, private and public colonization or organized settlement of land, the size of landholdings, tenancy in an ideal system of land ownership (E. S. R., 41, p. 292), leasehold v. freehold, land credit and its instrumentalities, and the real estate business. Chapter 7 on the taxation of land is essentially the same as a paper previously noted (E. S. R., 47, p. 692). Likewise, chapter 9 consists of the address noted earlier (E. S. R., 47, p. 297). The appendix contains abstracts from a review by Ely covering the Wakefield theory of colonization.

Rural credits (U. S. Senate, 67. Cong., 4. Sess., Com. Banking and Currency. *Hearings on Senate Bills to Provide Credit Facilities for Agr. and Live Stock Indus. in U. S., [etc.] 1922, pp. 402*).—The statements by E. Meyer, A. Sapiro, J. C. Jewett, and other representatives of farmers' organizations, publishers, Members of Congress, and representatives of Federal institutions are presented here as submitted in hearings between December 12 and 30, 1922.

Principles of marketing, F. E. CLARK (New York: Macmillan Co., 1922, pp. XIII+570, figs. 10).—Chapters 1 to 6, inclusive, of the 26 chapters of this functional treatment of the marketing process deal with the general nature of marketing and marketing functions and discuss problems, methods, and the machinery used in marketing farm products. Chapter 6 on marketing raw materials treats the subject from the buying rather than from the selling point of view.

Organized produce markets, J. G. SMITH (London and New York: Longmans, Green & Co., 1922, pp. IX+238, figs. 7).—This volume is based upon classroom lectures and is intended primarily for the use of students. It covers cotton, wheat, corn, sugar, and coffee exchanges in Great Britain, the United States, and in various other countries, the most important of which is Germany. Several chapters are devoted to a discussion of crop reports and market price quotations, future trading, speculation and its influence upon prices, methods of spot markets, and marketing by auction. Appendixes contain the text of the U. S. Future Trading Act of 1921, examples of market reports and warehouse

receipts and warrants, as well as sample forms for contracts largely of the Liverpool cotton market.

Bremen Cotton Exchange, 1872-1922, A. W. CRAMER, trans. by C. F. C. UHTE (*Bremen: Franz Leuwer, 1922, pp. 72, pl. 1*).—This consists of a number of sketches setting forth the history and operation of the Bremen Cotton Exchange, prepared in commemoration of its fiftieth anniversary.

The Root Vegetables Act, 1922 (*Ottawa: Canada Dept. Agr., Fruit Branch, 1922, pp. 10*).—The text is given of an act to regulate the sale and inspection of root vegetables by which grades and package regulations were fixed for Canada. Annexed regulations relative to the containers in which potatoes must be packed are included.

Sales methods and policies of a growers' national marketing agency, A. HOBSON and J. B. CHANEY (*U. S. Dept. Agr. Bul. 1109 (1923), pp. 36, figs. 11*).—The American Cranberry Exchange, which is the subject of this study carried on by Columbia University and the Bureau of Agricultural Economics, U. S. D. A., cooperating, is the culmination of efforts at organization on the part of cranberry growers in Wisconsin, New England, and New Jersey. It is composed of three State units, of which the New England Cranberry Sales Company is the largest. It is described in detail.

Improvements have been brought about by this national selling agency along five different lines, namely, in the matter of grading, by the establishment of pooling systems, by systematic national advertising, by cooperation with the trade, and by coordinating demand and supply. The organized growers control approximately 65 per cent of the cranberry supply. It is shown here, however, that artificial price control is practically impossible, mainly because artificial restriction of acreage is impossible in the short run and the crop is susceptible to the usual uncontrollable vicissitudes of agricultural production. Furthermore, the demand is influenced by the supply of competing fruits, the price of sugar, and the consumer's purchasing power and good will.

Marketing expenses are set forth in considerable detail. It appears that the grower received 54 per cent of the retail price of a barrel of cranberries in the crop year 1920-21, the retailer 22.4, the jobber 10.5, transportation 7.4, local and central cooperative marketing associations 3.5, advertising 1.5, and other wholesalers 0.7 per cent.

The efficiency of the cranberry growers' marketing organization is held to be proved by the facts that during the year 1920 with a crop 95 per cent of normal and in spite of rapidly falling prices on practically all commodities, the cranberry market advanced throughout the selling season and the grower received a greater percentage of the consumer's dollar than has the producer of many other perishable food commodities.

Marketing by cooperative sales companies, T. MACKLIN (*Wisconsin Sta. Bul. 346 (1923), pp. 3-32, figs. 10*).—Attention is directed to the Wisconsin Cheese Producers' Federation (*E. S. R., 44, p. 692*), which is a cooperative national sales company owned by farmers and operated by expert management engaged by the board of directors. There were 4,368 farmer patrons of the 168 local cheese factories holding membership in the federation in 1921. This organization among cheese producers is made up of three essential parts, first the local cooperative cheese factories or associations, second the district exchanges with their cold storage warehouses and equipment for paraffining cheese, and third the sales organization noted here. The services of each of these sections are described. The cheese federation is said to have narrowed the margin by an average of 4 cts. on the dollar of sales, and this saving goes to the cheese producers of the State as a result of their cooperation.

Accounting records for live stock shipping associations, F. ROBOTKA (*Iowa Sta. Bul.* 209 (1922), pp. 145-200, pls. 5, figs. 12).—Sample forms are given, with detailed descriptions of accounts and procedure. This material is supplemented with a constructive analysis of business practices for cooperative live-stock marketing.

Weather, Crops, and Markets (*U. S. Dept. Agr., Weather, Crops, and Markets*, 3 (1923), Nos. 5, pp. 81-112, figs. 2; 6, pp. 113-128, figs. 3; 7, pp. 129-160, figs. 2; 8, pp. 161-184, figs. 4).—Temperature and precipitation charts for the weeks ended January 30 and February 6, 13, and 20, 1923, with weekly summaries of weather conditions and a year's temperature summary noted on page 715, are presented here, together with the usual tabulated weekly and monthly reports and special articles pertaining to receipts and prices of important classes of crops and live stock and the position in the market of particular commodities. Foreign market notes are included in Nos. 5 and 7. Articles descriptive of the markets of Cincinnati and South Water Street in Chicago appear in Nos. 5 and 8, respectively. Crop reports in No. 5 include the entire January report on farm animals, monthly price tables, special tables showing farm prices of many products for the past 10 years, and special reports on specific crops. No. 7 presents an extensive survey of the value of farm products in 1922, with summaries for earlier years and by geographic divisions, a report on farm wage rates, a summary of crop damage through a period of years, and the usual farm value tables. A report of the acreage and condition of truck crops in 1923, with comparisons, appears in No. 8.

Farmers' Market Bulletin (*North Carolina Sta. Farmers' Market Bul.*, 9 (1922), No. 58, pp. 8; 10 (1923), Nos. 59, pp. 8; 60, pp. 8).—These numbers contain the usual partial lists of products which farmers have for sale.

The planters of colonial Virginia, T. J. WERTENBAKER (*Princeton, N. J.: Univ. Press; London: Humphrey Milford, Oxford Univ. Press*, 1922, pp. 260).—The customs of landholding and the methods of providing and maintaining the labor supply which developed about the tobacco-growing industry are here regarded as the key to the history of colonial Virginia. An account of the immigration into the colony of indentured laborers for tobacco plantations and the development of a Virginia yeomanry class in the seventeenth century is given in detail.

The early sources of information indicate that the colony was made up of little farms, a few hundred acres in extent, owned and worked by a sturdy class of English farmers.

Difficulties attendant upon the Navigation Acts and the introduction and rapid increase of negro slavery in the eighteenth century, bringing with it a development in the direction of large landholding, are pointed out. The appendix gives the rent roll of Virginia by counties, 1704.

Agriculture on Cape Cod, W. WHEELER and G. L. PARKER (*In Population and Resources of Cape Cod. Boston: Mass. Dept. Labor and Industries*, 1922, pp. 28-38, pls. 3).—These pages of a special report in recognition of the three-hundredth anniversary of the settlement of New England present several short signed reports covering, respectively, cranberry culture, the strawberry industry, the Cape Cod farm bureau, the poultry association, and the Coonameissett ranch.

[Agricultural production in Canada], G. T. MILNE (*In Report on Financial, Industrial, and Commercial Conditions in Canada. London: [Gt. Brit.] Dept. Overseas Trade*, 1922, pp. 22-25).—The agricultural situation in 1921 is briefly summarized.

English agriculture since 1914, I-III, R. LENNARD (*Jour. Polit. Econ.*, 30 (1922), Nos. 5, pp. 597-622; 6, pp. 750-770; 31 (1923), No. 1, pp. 21-46).—English agriculture is said to have been in a fairly prosperous condition at the

outbreak of the war. The landowners suffered some financial loss during the war period, but farmers undoubtedly prospered. To the agricultural laborer the war brought an increase in wages and a reduction of hours, although it is held that the agricultural minimum wage might have been established if there had been no war. Agricultural trade unionism was stimulated, and agricultural employers as well as their employees extended their organization. The general optimistic attitude that prevailed immediately after the signing of the armistice is accounted for. The findings of the Royal Commission, appointed in July, 1919, with regard to guaranteed prices as embodied in interim, majority, and minority reports are reviewed, and the contemporary history of agricultural affairs, including the three phases of prices, wages, and the sale of agricultural estates, is traced in considerable detail. The storm of protests with regard to the 1920 price of wheat is described, and the permanent policy of the Government as embodied in the Agriculture Act that came into operation on January 1, 1921, is set forth. The policy of guaranteeing minimum prices for wheat and oats was terminated in June, 1921. A slump in prices and wages is noted in the following months, but it is also pointed out that a considerable fall in the cost of production took place in the latter part of that year. Other minor topics and related events are noted.

Report of the agricultural policy subcommittee of the reconstruction committee, appointed in August, 1916, to consider and report upon the methods of effecting an increase in the home-grown food supplies, having regard to the need of such increase in the interests of national security, EARL OF SELBORNE ET AL. (*London: [Gt. Brit.] Min. Reconstr., 1920, pp. 136, figs. 2*).—This is the complete report, parts of which have been noted earlier (*E. S. R.*, 39, p. 402), and part 1 of which was practically embodied in the Corn Production Act of 1917 for Great Britain. An historical preface is submitted by A. Goddard. Recommendations in part 1 relate to the subjects of agricultural wages, prices of wheat and oats, methods of securing increased production, and the establishment in England and Wales of the sugar-beet industry. A minority report is submitted by M. Wallace.

Part 2 sets forth the organization of the Irish and Scottish Boards of Agriculture and the Ministry of Agriculture and Fisheries for England and Wales, emphasizing the facilities for agricultural instruction and research. The organization of agriculture and the future of agricultural cooperation are also discussed.

The first appendix gives a complete summary of the recommendations submitted in parts 1 and 2. Besides this and the list of witnesses who gave evidence, the 15 appendixes contain signed memoranda, extracts from earlier reports, and special reports, with recommendations.

Recent economic developments in Russia, K. LEITES, edited by H. WESTERGAARD (*Oxford, Eng.: Clarendon Press; New York: Humphrey Milford, 1922, pp. 240*).—Sections of each of the three parts of which this publication is composed, namely, the general effect of the world war on the economic life of Russia prior to the Bolshevik Revolution, results of the economic policy of the Bolsheviks, and economic life in Soviet Russia in 1920, are devoted to the agrarian question and food supply.

Agriculture and forestry [in Czechoslovakia], compiled by J. ČISAŘ and F. POKORNY (In *The Czechoslovak Republic*. *London: T. Fisher Unwin, Ltd., Prague: Orbis Pub. Co., 1922, pp. 89-101*).—This chapter from a compiled survey of the history and geography, organization, and economic resources of this region gives statistics of agricultural production in recent years, and notes on agricultural education and land reform.

Survey of the economic and commercial conditions in Algeria, Tunis, and Morocco, 1921-1922 (London: [Gt. Brit.] Dept. Overseas Trade, 1922, pp. 128, pls. 3).—Sections of this report are devoted to the agricultural production of these regions and of the consular district of Tetuan. Appendixes give statistics, mainly of exports and imports.

International yearbook of agricultural legislation (*Inst. Internatl. Agr.* [Rome], *Ann. Internatl. Lég. Agr.*, 11 (1921), pp. LXI+1380, figs. 4).—This compilation of the legislation of 1921 continues the series previously noted (*E. S. R.*, 46, p. 292).

The agrarian crusade, S. J. BUCK (*New Haven, Conn.: Yale Univ. Press; London: Humphrey Milford, Oxford Univ. Press*, 1921, pp. XI+215, fig. 1).—The history of the Granger movement to its decline in 1875 and 1876, as well as of the Greenback and Populist movements and the political issues of the nineties, is sketched in these pages. Various later efforts at organization among farmers are briefly mentioned.

The cooperative association law of Maryland, F. B. BOMBERGER (*Md. Univ. Ext. Bul.* 26 (1922), pp. 17).—There is presented here a summary and the text of the law enacted by the legislature of 1922.

The cooperative movement in Yugoslavia, Rumania, and North Italy during and after the World War, D. COFFEY (*New York and London: Oxford Univ. Press*, 1922, pp. VII+99).—Notes are given with reference to numerous individual societies, and the trend of development of the cooperative movement in these regions is interpreted.

The extent and control of rural child labor, C. E. GIBBONS (*Jour. Rural Ed.*, 2 (1922), No. 2-3, pp. 131-136).—Child labor is said to exist under general farming conditions, but to be found in its most pernicious form in the one-crop system, where it needs to be remedied by legislation. A stricter enforcement of compulsory education and more protection for health and opportunity for wholesome play are needed.

The rural press as an educational agency, C. C. TAYLOR (*Jour. Rural Ed.*, 2 (1922), No. 2-3, pp. 112-118).—The author studied first the subject material of agricultural journals and agricultural college curricula in seven different States from 1880 to the present, and arrived at the conclusions that agricultural education has had three distinct phases, (1) general education with very little agricultural connotation, which phase lasted until about 1885 or 1890; (2) education in technical or scientific production, which began about 1890 and still prevails; and (3) business and social education, which began about 1915. He holds that the agricultural journals have led the agricultural colleges from 5 to 15 years in making transitions and additions in subject materials. The southern agricultural journals have led the colleges in that region more markedly than the northern journals have the northern colleges.

The space given the different farm subjects in eight agricultural journals selected from all sections of the country and representing about 10 per cent of the total circulation of all the agricultural journals was analyzed, and the percentages devoted to different items are tabulated here. Of the space other than advertising, which amounted to 44.8 per cent of the total space, 37.8 per cent was devoted to technical production, 13.6 to fiction and nature study, 12.05 to marketing, 8.7 to home and family, 7.1 to cooperation other than marketing, 4.5 to citizenship and politics, 4.2 to education and school, 3.5 to social news and contacts, 2.9 to agricultural engineering, 2.3 to health and sanitation, 1.6 to transportation and communication, 0.67 to recreation, 0.38 to labor, and 0.29 to religion and the church.

It is held that the traditional agricultural journals, and especially the country weeklies, have still undeveloped possibilities for rural leadership and rural service.

[**Agricultural statistics of Scotland, 1921**], J. M. RAMSAY (*Scot. Agr. Statis.*, 10 (1921), Nos. 1, pp. 50; 2, pp. 51-74; 3, pp. 75-100).—These statistical reports continue the official series previously noted (E. S. R., 46, p. 496).

AGRICULTURAL EDUCATION.

Educational achievement, M. E. HAGGERTY (*Ithaca, N. Y.: Joint Com. on Rural Schools, 1922*, pp. [4]+224, figs. 38).—This and two noted below belong to a series of reports on the rural school survey, one of which was previously noted (E. S. R., 47, p. 597).

For the purpose of this study the State was divided into seven districts, within each of which particular counties were chosen, and in each county single supervisory districts were selected where the silent reading test was given in every school. Certain other tests were given in some of the higher grades. In addition to tests in these districts examinations were also given in a consolidated school, junior high schools in Rochester and Buffalo, and the senior high school at Syracuse. Over 14,000 pupils in 441 schools were examined.

A report is made here in which the scores of pupils taking the reading tests are tabulated and graphically presented, as are also the scores from social intelligence tests. Such problems as the classification of pupils for instructional purposes, their progress, the efficiency of the school organization, administration, and teaching are discussed, and chapters are devoted to the findings with regard to the proficiency of the pupils in American history, spelling, arithmetic, algebra, and Latin, respectively.

The problem for first consideration is deemed to be the improvement of the ability on the part of elementary pupils to read English prose. A second outstanding matter for recommendation is the situation with regard to the teaching of American history, and a third recommendation is based upon the possible use of intelligence and achievement tests in school supervision. The continuation and extension of work along this line, both locally and through the State organization, are urged. It is said that practically every inference to be derived from the test results points to the advantage of the larger school unit, and a final recommendation is made in favor of consolidation as against the one-teacher school unit.

The rural high school, E. N. FERRISS (*Ithaca, N. Y.: Joint Com. on Rural Schools, 1922*, pp. 188, figs. 15).—The data used as the basis of this study of the organization, administration, and supervision of the rural high schools in New York State were derived mainly from statistics and reports from the State Department of Education, the 405 replies to a questionnaire sent to all rural high school principals, and the visitation of over 75 rural high schools in all sections of the State. This report is presented in two parts, part 1 covering organization, administration, and supervision. Part 2, relating to the teaching staff, classroom instruction, and the curriculum, is based on data from 416 principals and teachers composing the teaching corps of 123 rural high schools representing 43 counties in the State.

It was found that a large proportion of the instructors in these schools are immature and inexperienced. Of the entire teaching staff, 3 in 10 are men. Practically 9 out of every 10 instructors are of American stock. Approximately 3 in 5 of the teaching staff have had academic and professional training equal to graduation from a standard college, but it is indicated that as a group

they give a small amount of time to those things tending toward professional growth. The percentage attending summer schools is only 18 per cent.

Recommendations are made principally with regard to standard requirements for academic and professional training. A detailed report is given of the findings derived from observations of classroom recitations. Statistics and reports of the State Department of Education and reports coming directly from the principals of rural high schools are summarized to indicate the present content of the curriculum.

Vocational education, T. H. EATON (*Ithaca, N. Y.: Joint Com. on Rural Schools, 1922, pp. 294*).—Regulations, policies, and aims of vocational education in agriculture and home making in general are discussed.

It appears that of the 108 vocational courses in agriculture established in high schools in New York State since October, 1911, there remained in May, 1921, 76 schools providing instruction in agriculture and receiving aid therefor from State and Federal funds. During April and May, 1921, 26 schools were visited for one day each in order to observe the teaching of agriculture, and a detailed report is presented from which it is indicated that on the whole those boys to whom the agricultural work is accessible are being rather well taught.

Chapters are presented setting forth the salaries and qualifications of teachers of both agriculture and home making, aims, enrollment, equipment, and content of the courses.

[Eleventh and twelfth reports of the Development Commissioners for the years ended March 31, 1921, and 1922], R. CAVENDISH ET AL. (*[Gt. Brit.] Development Commrs. Rpt., 11 (1921), pp. IV+111; 12 (1922), pp. V+138*).—These indicate the projects for which grants were made in aid of agricultural education and organization, as well as the numerous other activities of the commission.

[Laws and decrees relating to agricultural education] (*Enseignement Agricole. Lois, Décrets, Arrêtés, Circulaires et Instructions. Paris: Min. Agr., 1921, pp. 246*).—The text of the laws of August 2, 1918, and of August 5, 1920, as well as of miscellaneous legislation relating to agricultural education in France, is given here, with brief comment.

The organization of dairy education in Belgium, A. C. BOVY (*Jour. Soc. Natl. Agr. Belg., 4 (1922), No. 32, pp. 257-259*).—This is the report of a special commission appointed to study the organization of technical education for dairying and to elaborate a program for it. The plan is outlined whereby a certain chateau will be equipped as a school, and courses will be given covering dairy technology; bacteriology, hygiene, and dairy chemistry; mechanics; animal husbandry; elementary agriculture; commercial law; and farm buildings. Special courses will be offered for dairy foremen and directors of dairy enterprises. A commercial dairy will be conducted by the pupils of the school in order that they may be provided with practice.

The fifty years' history of the higher State institute of wine, orchard, and garden culture at Gelsenheim-on-the-Rhine, LÖCKERMANN (*Fühling's Landw. Ztg., 71 (1922), No. 21-22, pp. 406-415*).—The history of the establishment of this school in the wine-growing region in the Province of Hesse-Nassau is recounted here, and its staff, research and teaching departments, experimental plats, equipment, and teaching aims are described.

The importance and profitableness of agricultural instruction, H. BEHLEN (*Fühling's Landw. Ztg., 71 (1922), No. 21-22, pp. 415-432*).—The author cites an inquiry by Ruoss into the measurable improvements in agricultural practice on the parts of former students in the agricultural winter schools

in Hanover, and gives the results of his own inquiry by questionnaire and interview as to the progress shown by about 20 operators who had attended the Mengerlinghausen winter school in Waldeck. He notes that results were much the same, the use of improved implements and fertilizers, increased crop yields, greater returns from pasture, improvement in live stock, increase in milk yields, and a higher net income being found in both cases. The author calculates a return to these former students of about 50 per cent on their investment in the winter school course. Conjectures are made as to the effect on the agriculture of the country as a whole and by provinces, if these or similar results are obtained by the majority of the students at agricultural schools.

Report on agricultural and small holdings schools, 1920-21 ([Norway] *Landbr. Direkt. Årsberet., 1920-21, Tålegg L, pp. [813], figs. 22*).—Numerous reports are included here, continuing information previously noted (E. S. R., 48, p. 496.)

The potato: Its culture, uses, history, and classification, W. STUART (*Philadelphia and London: J. B. Lippincott Co., 1923, pp. IX+518, pls. 5, figs. 267*).—This is a college text on potato production in North America, in which the author discusses the basic principles underlying production and includes information with regard to the industry as a whole. The material is arranged in two parts, the first dealing with production, the second with the botany of the potato, its origin and early history, breeding and selection, and the classification and description of commercial varieties. In the potato project outline given in the appendix, operations and studies are arranged in seasonal sequence for the benefit of students and farmers who plan to grow this crop for profit.

The school book of forestry, C. L. PACK (*Washington: Amer. Tree Assoc., 1922, pp. 159, pls. 16*).—Habits of forest growth, forest types, economic uses of forest trees, and their enemies such as fire and pests and diseases are set forth in early chapters. The growth of the forest idea and some of the problems connected with forest protection are described. Finally, chapters are presented on the value of practicing forestry to the United States, the lumberman, and the farmer, respectively. Technical studies of wood uses and the extent of the national forests of the United States as compared with those of other countries are noted.

An analysis of textbooks in clothing and textiles, E. I. PHELPS (*Jour. Home Econ., 14 (1922), Nos. 10, pp. 471-477; 12, pp. 625-632*).—A list of 43 clothing and textiles textbooks, all of which were of American origin with the exception of 4 which were English, were analyzed for this study, and the subject matter presented in them was compared on the basis of 54 carefully defined subtopics, as, for example, drafting and pattern making, principles of clothing, designing, sewing, sketches, etc. The dates of copyright of these books ranged from 1882 to 1921. Twenty-seven of them were issued during the decade ended with 1919.

It appears that the space allotted to sewing processes has declined, while that devoted to garment construction has increased. The subject of textiles has received a greater share of attention in later books. Illustrations have increased in number and improved in quality, and indexes and bibliographies are being used more freely.

NOTES.

Hawaii Federal Station.—Miss Mabel Greene, club leader for Benton County, Wash., has been appointed boys' and girls' club leader with the extension division, beginning April 1.

Iowa College.—A new hog barn of brick and hollow tile and costing \$4,200 has recently been erected.

Kentucky University.—A gift of \$1,000,000 and 16,000 acres of timber land has been made by E. O. Robinson of Fort Thomas to be used in the educational, agricultural, and economic development of the mountaineers of eastern Kentucky. This fund is to be held in trust by the newly incorporated E. O. Robinson Mountain Fund, and the university has been asked to take active charge of the work of development which is in contemplation.

Massachusetts College.—The State legislature paid a visit to the college May 4. This is the first time the institution was ever inspected by the legislature as a whole, and one of the few trips of that body to any point in recent years. A large proportion of the legislators were present, and much interest was expressed in the work and needs of the institution as presented.

Data recently compiled show that of the total number of 2,043 alumni of the college, 283 have received advanced degrees, including 75 as master of science, 54 as doctor of philosophy, and 42 as doctor of medicine. The institutions granting the largest number of degrees are Harvard with 51, the college itself 46, Columbia University 18, and Cornell and Yale Universities 17 each. Of the 1,664 nongraduate former students, 172 have received degrees from other institutions.

Ralph A. Van Meter, extension professor of pomology, has been appointed professor of pomology and will be engaged in resident teaching, being succeeded by F. E. Cole, jr. Morton H. Cassidy has been appointed assistant professor of beekeeping.

Minnesota University.—Plans have now been completed and construction begun for the new dairy building, which it is hoped will be ready for occupancy in June, 1924. This will be a counterpart of the agricultural engineering building, with three stories and basement, 60 by 157 ft., and with a 1-story wing in the rear, 66 by 93 ft.

The basement will be largely used as a laboratory for the short courses, and for housing all the creamery, market milk, and ice cream making machinery. The first floor will contain classrooms and laboratories; and the second floor offices, laboratories for the dairy bacteriological work, and the use of the station, a reading room, classrooms, and offices. The third floor will be held in reserve, unfinished, to provide for future needs.

An appropriation of \$235,000 is available for the new building, in addition to from \$25,000 to \$35,000 for equipment and furnishings.

Mississippi Station.—F. B. Richardson has resigned as horticulturist for the South Mississippi Substation at Poplarville, and will be succeeded by W. C. Anderson.

Missouri University.—Dr. S. D. Brooks, president of the University of Oklahoma, has been appointed president. M. F. Miller, chairman of the department of soils, has been granted leave of absence for nine months, to be spent in observing the soils of the Middle Western States. A. M. Burroughs has been appointed instructor in horticulture, and H. M. Harshaw instructor in agricultural chemistry.

New York State Station.—The station news service begun in January, 1922, has proved very successful, reaching a large number of people otherwise inaccessible. It is estimated that the papers carrying the station news material have an aggregate circulation of more than 45,000,000 people. Papers as far north as Maine and Canada, as far west as the Pacific coast, and as far south as Tennessee and Virginia made frequent use of the service.

The station entomologists are cooperating with E. H. Eaton of Hobart College, author of *The Birds of New York* and a student of bird life, in a series of experiments to determine the actual value of certain birds in combating the pear psylla, the most destructive pest of pear trees in the State. Most birds have generally been regarded as beneficial to agriculture, but some bird students have come to feel that in the absence of definite information too much has been taken for granted in this respect. The object of the test is to devise ways and means of attracting larger numbers of birds to the pear orchards and to encourage them to make their nests there. A considerable number of bird boxes have been placed in pear orchards near the station grounds, and dead limbs for the use of woodpeckers have been put in near-by hedge rows. A supply of suet and sunflower seed is also to be kept readily available, and it is hoped that with shelter and an abundance of food many more birds will be attracted to the orchards. Examinations of the stomach contents of several birds have revealed large quantities of psylla, and those in charge of the work expect that the birds will prove an appreciable control factor.

Texas College.—George P. Grout has been appointed chief of the dairy division.

Vermont Station.—The general assembly has passed an amendment to the commercial feeding stuffs law providing for the assessment of license fees. Any excess of funds not needed for the conduct of the control work may be used in part for the carrying out of feeding experiments with dairy cattle, swine, and poultry.

National Research Council Fellowships in the Biological Sciences.—An additional series of research fellowships has been established by the National Research Council with the financial support of the Rockefeller Foundation and the General Education Board. This series will provide for the biological sciences, and is made possible by a gift of \$325,000 from the Rockefeller Foundation to be expended during the five years ending June 30, 1928.

The object is the promotion of fundamental research in the biological sciences. It includes both the immediate acquisition of more knowledge through research and the securing of a greater number of trained investigators. Opportunity is to be offered to persons who have already demonstrated a high order of ability to continue their research at suitable institutions, preferably in this country. The list of accredited institutions will include museums, Government bureaus, special research institutes, and similar institutions, as well as colleges, universities, and technical schools.

The fellowships will be adjusted in amount to circumstances, with a basic stipend for first appointments at \$1,800. Applications for the fellowships are being received by the Secretary, Board of Fellowships in the Biological Sciences, National Research Council, Washington, D. C.

Forestry Research at Harvard and Yale.—An anonymous donor has given \$100,000 each to Harvard and Yale Universities as endowment funds for research on forestry problems.

At Harvard the income from the fund will be used for experimental work to determine the basic facts essential to the successful practice of silviculture in the northeastern section of the United States, especially New England. The gift will make possible the enlargement of the work carried on for the past 14 years at the university forest of over 2,000 acres at Petersham, Mass. It is expected that the gift to Yale will be utilized for additional field studies in the growth and production of pine in the university experimental forest at Keene, N. H., and of hemlocks and hardwoods on its holdings in Connecticut.

Forestry Bequest in Massachusetts.—Under the will of the late D. Blakeley Hoer of Brookline, Mass., the principal and income remaining from his estate upon the death of various beneficiaries are to be used for acquiring land, preferably on the watershed of the Charles River, for handling as forests and bird preserves. Any profits returned by the forests are to be divided between the town of Brookline and its public library.

New Entomological Laboratory in Ceylon.—In a recent issue of the *Tropical Agriculturist* an account is given of the opening of a new entomological laboratory situated at the very entrance of Peradeniya, the heart of the agricultural life of Ceylon. This laboratory consists of two rooms for entomologists, three rooms for assistants, students, and the clerical force, a dark room, an insectary, a store room, a library and lecture room, and a room for collections. The opening of this laboratory and a similar mycological laboratory took place on October 10, 1922, at which the governor and the director of agriculture for the colony made addresses.

Memorial Tablet to G. Harold Powell.—A bronze tablet in memory of the late G. Harold Powell (E. S. R., 46, p. 199) was unveiled April 25 in the corridor of the administration building of the U. S. Department of Agriculture. The tablet was a gift of some of Mr. Powell's associates in the U. S. Food Administration and was presented by Frank A. Horne of New York City on behalf of the donors. An address for the Food Administration was made by Secretary Hoover of the Department of Commerce, and the tablet was accepted for the Department of Agriculture by Secretary Wallace. The inscription is as follows:

George Harold Powell

Born February 8, 1872

Died February 18, 1922

Agriculturist

Economist

Public Servant

U. S. Department of Agriculture 1901-1910 U. S. Food Administration 1917-1919

From the earth his understanding and patience brought increase of fruitage.
From life his deep wisdom and radiant personality wrought productive friendships among his fellow men.

Presented in memory of his high ideals and great usefulness by some of his former associates in the public service.

Necrology.—Ignaz Vogel, agricultural bacteriologist and mineralogist, died December 29, 1922, at the age of 52 years. Professor Vogel served as bacteriologist at the agricultural experiment station at Posen from 1900 to 1905, and for the ensuing nine years in the Emperor William Institute at Bromberg. In 1914 he succeeded Dr. F. Löhns as director of the bacteriological department of the Agricultural Institute of the University of Leipzig. He had published a number of researches on the occurrence and transformations of the various sugars in the bodies of plants and animals, the fixation of atmospheric nitrogen, and other topics related to the bacteriology of soils and manure. He

was also editor of the agricultural section in the *Handbuch der Milchwirtschaft*.

New Journals.—*Empire Forestry* is the title of a new journal issued by the Empire Forestry Association of the Imperial Institute of London. This association was organized November 16, 1921, as a federation of the various associations, groups, and individuals engaged or interested in the growth, marketing, and utilization of timber in the British Empire, and with the Prince of Wales as president.

The initial number contains several original articles, together with editorial notes, reports, reviews, and other bibliographical and statistical material. The original articles are entitled *Forestry in the Empire*, by R. L. Robinson; *Western Australia as a Producer of Fine Timber*, by C. E. Lane-Poole; *Forest Fires in Canada*, by E. Wilson; *Timber Testing in India*, by L. N. Seaman and R. S. Pearson; *Sylvicultural Treatment of Eucalypts*, by G. E. Brockway; *The Australian Forest League*, by W. R. Grunwade; *The Douglas Fir Flagstaff at Kew*, by F. R. S. Balfour; and *Tree Worship in India*, by S. M. Edwards.

Zeitschrift für Pflanzenernährung und Düngung is being published by Drs O. Lemmermann, director of the Institute of Agricultural Chemistry and Bacteriology with the Agricultural High School of Berlin and superintendent of the agricultural experiment station for the Province of Brandenburg, and Paul Ehrenberg, director of the Institute of Agricultural Chemistry and Bacteriology of the University of Breslau. This journal is to be issued in two parts, a technical section of 6 numbers per year of about 64 pages each and a less technical section of 12 numbers per year of about 40 pages each. The initial number of the second section contains articles on the *Nutrition of Plants and Man*, and the *Law of Diminishing Soil Fertility and Its Significance as to Manuring*, both by Dr. Lemmermann; and on *Fertilizer Experiments and Practice*, by Schuarg; several short contributions on various fertilizer topics; and abstracts of 14 articles from German and Swedish sources on fertilizers. The first section contains an article entitled *Factors in Formation of Soil Acids*, by Dr. V. König, Dr. J. Hasenbaumer, and E. Kroger; *Investigations on Soil Acidity and Its Influence on the Germinating Plant*, by O. Lemmermann and L. Fresenius; and *The Question of Carbon Dioxid*, by Dr. Densch; and abstracts of 18 publications from German sources.

Bothalia, taking its name from the late General Botha, first Premier and Minister of Agriculture for the Union of South Africa, is being issued as the official medium of publication of papers and monographs based on material in the new National Herbarium. Dr. I. B. P. Evans, chief of the division of botany and plant pathology in the Department of Agriculture and director of the botanical survey of the Union of South Africa, is editor. The initial number contains four contributions entitled *South African Ascomycetes in the National Herbarium*, by E. M. Doidge; *The Genus Bersama, and the Natal Species of the Sapindaceae*, both by E. P. Phillips; and *A Revision of the African Species of Sesbania*, by E. P. Phillips and J. Hutchinson.

The *Journal of Pomology* has been rechristened the *Journal of Pomology and Horticultural Science* and will become in effect the official organ of the horticultural research stations in England. The stations at East Malling, Long Ashton, and Cambridge have assumed financial responsibility, and publication is to be carried on quarterly with E. A. Bunyard as editor and a publication committee representing the above-mentioned institutions and the Ministry of Agriculture and Fisheries.

O Agricultor is being published as the official organ of the Agricultural Club of the School of Agriculture of Lavras, State of Minas-Geraes, Brazil.

The initial number contains the constitution of the club and reports of some of its proceedings, brief articles on current agricultural topics by the director of the school, Dr. Benjamin H. Hunnicutt, and other members of the faculty, miscellaneous notes, etc.

Journal of Scientific Instruments is a monthly publication dealing with their principles, construction, and use. It is issued at London by the Institute of Physics with the cooperation of the National Physical Laboratory. The initial number contains a discussion of the need of a journal of this type by Sir J. J. Thompson and Dr. B. H. Royner, the acting editor, and numerous original articles, abstracts, notes, etc. Among the original articles is one on Instruments and Apparatus in Relation to Progress in Physiology, by Dr. A. V. Hill.

The American Medical Association is publishing *Hygeia* as a "journal of individual and community health." The initial number contains a considerable variety of articles of medical interest, including What is a Chromosome? by J. Huxley; Louis Pasteur and His Work, by V. C. Vaughan; and The House Fly—Carrier of Disease, by L. O. Howard.

Zentralblatt für die gesamte Hygiene und ihre Grenzgebiete has been established as the official organ of the Berlin Gesellschaft für öffentliche Gesundheitspflege. The initial number contains an article by E. Martini entitled Review of Diseases and their Dissemination as Indicated by the Present Status of Research on Insects, either Alone or as Active Factors; and about 200 abstracts of the literature.

Annali dell' Istituto Sperimentale di Caseificio in Lodi is being issued periodically by the Royal Experimental Cheesemaking Station at Lodi, Italy. The initial number contains the text of the royal decree of November 20, 1919, establishing the station, an account of its equipment, work, and progress, and other data regarding its activities.

The National Research Council of Japan is publishing *Japanese Journal of Botany* from time to time. The initial number contains a contribution in German entitled Investigations of Fungus Sports in the Atmosphere, by K. Saito, and abstracts in English, French, or German of 38 papers on botany and allied subjects which appeared in Japan from January to June, 1921.

The National Society for Vocational Education is publishing *Vocational Education Magazine* as a monthly. A large number of short articles on various phases of vocational education appear in the initial number, together with editorials, book reviews, news notes, etc.

Mexico Forestal is the monthly organ of the Mexican Forestry Society. The initial number deals with the formation and membership of the society and discusses a number of forestry problems, including the need of a comprehensive forest law.

Archivio di Patologia e Clinical Medica is being published at Bologna. Among the articles in the initial number is one entitled The Form of Diagnostic Activity, by G. Viola.

La Science du Sol is being published from the Agronomic Laboratories of G. Truffaut. The initial number is devoted to a paper by him in association with N. Bezssonoff entitled The Partial Sterilization or Disinfection of the Soil.

ADDITIONAL COPIES

OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.

AT
10 CENTS PER COPY
SUBSCRIPTION PRICE, 75 CENTS PER VOLUME

PURCHASER AGREES NOT TO RESSELL OR DISTRIBUTE THIS
COPY FOR PROFIT.—PUB. RES. 87, APPROVED MAY 11, 1928

EXPERIMENT STATION RECORD.

VOL. 48.

ABSTRACT NUMBER.

No. 9.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

History of chemistry, F. P. VENABLE (*Boston: D. C. Heath & Co., 1922, pp. VII+168*).—This is a brief but comprehensive history of chemistry from its earliest development to the present time, the final chapter being devoted to radioactivity.

An introduction to theoretical and applied colloid chemistry, W. OSTWALD, trans. by M. H. FISCHER (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd, 1922, 2. ed., enl., pp. XIII+226, figs. 47*).—This second English edition of the volume previously noted (*E. S. R.*, 38, p. 309) is a translation of the eighth revised German edition.

An introduction to the physics and chemistry of colloids, E. HATSCHEK (*London: J. & A. Churchill, 1922, 4. ed., rev. and enl., pp. XIII+172, figs. 20*).—The subject matter of the previous edition (*E. S. R.*, 42, p. 109) has been entirely rewritten and enlarged to include the more important work on the subject to the middle of 1921. The appendix on experimental technique included in the third edition has been omitted.

Industrial organic chemistry, S. P. SADTLER and L. J. MATOS (*Philadelphia and London: J. B. Lippincott Co., 1923, 5. ed., rev. and enl., pp. XVI+13-691, figs. 141*).—This volume deals with the industries of mineral oils, fats and fatty oils, essential oils and resins, sugar, starch and its products, fermentation, milk, cellulose, textile fibers of vegetable and animal origin, animal tissues and their products, wood and coal products, coal-tar dyes, natural coloring matters, and bleaching, dyeing, and textile printing. The method of treatment of each subject is essentially the same. The raw materials are enumerated and described; the processes of manufacture are explained; the physical and chemical products, both intermediate and final, are discussed, with important analytical tests; and the bibliography and statistics of each industry are given.

An introduction to the chemistry of plant products.—II, Metabolic processes, P. HAAS and T. G. HILL (*London and New York: Longmans, Green & Co., 1922, [3. ed.], vol. 2, pp. VIII+140, figs. 11*).—This volume completes the third edition of this work, the first volume of which has been noted previously (*E. S. R.*, 45, p. 201). It deals essentially with the synthesis in the living plant of fats, carbohydrates, and proteins, with plant respiration, and with the essential factors for growth in plants.

Some chemical aspects of agriculture, E. HOLMES (*Chem. Age [London], 8 (1923), No. 189, pp. 80-84*).—This is a general discussion of the application of chemistry to "the study and efficient use of soils, fertilizers, and feeding stuffs."

Progress in food chemistry, H. BECKURTS ET AL. (*Jahresber. Untersuch. Nahr. u. Genussmitl.*, 25 (1915), pp. 155; 26 (1916), pp. 233; 27 (1917), pp. 167; 28 (1918), pp. 149; 29 (1919), pp. 158; 30 (1920), pp. 124).—These are the year-books for 1915–1920, inclusive, covering the same subjects as in previous years (E. S. R., 42, p. 253).

A new globulin from the navy bean, *Phaseolus vulgaris*, H. C. WATERMAN, C. O. JOHNS, D. B. JONES, and S. PHILLIPS (*Jour. Biol. Chem.*, 55 (1923), No. 2, pp. 93–104).—The studies on the proteins of various beans (E. S. R., 48, p. 107) have been extended to a similar study of the navy bean (*P. vulgaris*).

Fractionation of a 2 per cent aqueous sodium chlorid extract with ammonium sulphate as precipitant gave two principal fractions, one the β -fraction, identical with phaseolin described by Osborne (E. S. R., 5, p. 1080), and the other an α -fraction, a hitherto unknown globulin to which the name conphaseolin has been assigned.

Conphaseolin has the same general properties as the α -globulin previously found in the Lima, mung, and adzuki beans. It has a high carbon and sulphur content, is precipitated by ammonium sulphate at a relatively low concentration, and is easily denaturable. The average distribution of nitrogen as determined by the Van Slyke method in two samples of this protein is reported as follows: Amid N 7.39, humin N adsorbed by lime 2.82, humin N in amyl alcohol extract 0.19, cystin, N 0.88, arginin, N 14.15, histidin N 1.47, lysin N 13.14, amino N (filtrate) 57.53, and nonamino N (filtrate) 2.58 per cent.

The percentage of basic amino acids is given as cystin 1.18, arginin 0.87, histidin 0.85, and lysin 10.60 per cent.

The isoelectric point of globin, S. OSATO (*Biochem. Ztschr.*, 132 (1922), No. 4–6, pp. 485–487).—The isoelectric point of pure globin from blood was found to lie between pH 7.8 and pII 8.3. This is said to be the first animal protein thus far reported to have an isoelectric point on the alkaline side of neutrality.

The separation of meat proteins, C. R. MOULTON (*Jour. Assoc. Off. Agr. Chem.*, 6 (1922), No. 1, pp. 76–85, fig. 1).—In the methods employed for the separation of meat proteins, the nitrogen of the meat soluble in cold water is divided approximately into globulin, albumin, proteose, peptone and peptid, and amino acid and extractive nitrogen.

The globulin and albumin nitrogen are coagulated from the cold water extract by heat in the presence of moist, freshly precipitated magnesium carbonate. The globulin is precipitated from the cold-water extract by half saturation with zinc sulphate, and from these two determinations the albumin is calculated by difference. Globulin, albumin, and proteose nitrogen are coagulated by saturated zinc sulphate when suitably acidified with sulphuric acid. Amino acid and extractive nitrogen are determined by coagulation with tannic acid and sodium chlorid, either in an aliquot of the original water extract or in the filtrate from the heat-coagulable protein. This method was found, however, not to yield results in triplicate of satisfactory agreement and is to be subjected to further study.

Data are presented on the distribution of the nitrogen as determined by the above methods in four samples of raw beef and in pigeon and squab flesh.

The hydrolysis of protein bodies with strong sulphuric acid, E. SAL-KOWSKI (*Biochem. Ztschr.*, 133 (1922), No. 1–3, pp. 1–20).—The study reported was undertaken to determine the possibility of utilizing as a food the products of hydrolysis with strong sulphuric acid of the proteins of horn, gelatin, and blood. It is noted that such a product, prepared by the hydrolysis of bones with concentrated hydrochloric acid, has already been used as a flavoring extract, but is unsuitable for use in larger amounts on account of its extremely salt taste. On heating these proteins for three hours with 3 volumes of a

solution of sulphuric acid containing 2 volumes of sulphuric acid to 3 of water, the proteins were completely hydrolyzed without the formation of humin. The hydrolysate contained practically the entire sulphur content of the original protein, about 1.9 per cent by weight of the ammonia, almost none of the aromatic groups, from 12 to 13 per cent of reducing substances which were for the most part precipitable by phosphotungstic acid, and traces of pyrrolic acid, aliphatic aldehydes, and furfural. From a practical standpoint the hydrolysate was found to have too unpleasant a taste for use as a food.

The catalytic destruction of carnosin in vitro, W. M. CLIFFORD (*Biochem. Jour.*, 16 (1922), No. 6, pp. 792-799, figs. 4).—From the results of determinations by the method previously noted (E. S. R., 47, p. 805) of the carnosin content of meat subjected to various treatments, the author has arrived at the conclusion that there exists in animal tissues a simple catalyst capable of destroying carnosin. The curves of destruction of carnosin are unlike enzyme curves, and are thought to indicate either that two agents of the nature of enzyme and coenzyme may be involved, or that the catalyst may be a single substance and the reaction take place in two phases separated by an inactive phase. The catalyst is thought to be present in vertebral skeletal muscle but not in invertebrates. The previous negative findings for carnosin in certain muscle tissues are now considered to be the result of the action of this catalyst. It is suggested that carnosin is an intermediary product of metabolism, and that its quantitative appearance in muscle is determined by the rate at which it is formed and removed in the different types of muscle.

The amino acids in the globulin-albumin fraction of beef flesh, C. R. MOULTON (*Jour. Assoc. Off. Agr. Chem.*, 6 (1922), No. 1, pp. 86-90).—Data obtained by slight modifications of the Van Slyke method on the nitrogen distribution of the globulin-albumin fraction of three samples of lean round beef are given as follows: Ammonia nitrogen, 6.18, 6.93, and 6.98 per cent; acid-insoluble humin nitrogen, 1.14, 0.82, and 0.55; acid-soluble humin nitrogen, 1.98, 1.75, and 1.68; phosphotungstate humin nitrogen, 0.69, 0.80, and 0.73; arginin nitrogen, 14.64, 12.98, and 14.10; cystin nitrogen, 1.40, 0.80, and 1.01; lysin nitrogen, 14.92, 11.96, and 14.96; histidin nitrogen, 2.76, 10.32, and 3.82; total nitrogen of the bases, 33.71, 36.05, and 33.88; amino nitrogen of the monamino acids, 55.34, 55.99, and 58.64; nonamino nitrogen of the monamino acids, 2.88, 2.61, and 2.59; total nitrogen of the monamino acids, 58.22, 58.60, and 61.23; total recovery, 101.92, 104.95, and 105.05; and total nitrogen in air-dry sample, 12.50, 13.61, and 13.40 per cent.

Variations in the Concord grape during ripening, H. A. NOYES, H. T. KING, and J. H. MARTSOLF (*Jour. Assoc. Off. Agr. Chem.*, 6 (1922), No. 2, pp. 197-205, figs. 3).—To obtain some information on the chemical changes taking place in Concord grapes during the entire harvesting period of from 20 to 25 days, parts of two vineyards in Westfield, N. Y., were set aside in the harvesting seasons of 1920 and 1921 and from 8 to 10 lbs. of grapes gathered from each of these sections three times a week during the entire harvesting period. From these collections samples were used for analysis of the whole grapes and for the preparation and analysis of cold-pressed and hot-pressed juices, the former being pressed at room temperature and the latter after heating for 5 minutes at 145° F. The data reported on the whole grapes include the weight of individual berry and the percentage of moisture and sugar, and on the juices the percentage of sugar, acid, and tannin and coloring matter. The results are given in averages of the samples from the two vineyards.

The data showed for both seasons no marked variation in the weight of the berry as the season advanced. The individual berry was lighter in the 1920 season than in the 1921 season, which started almost a month earlier. In both

seasons the sugar content of the berry increased and the moisture content decreased with an advance in the ripening period. No direct proportionality could be observed between the two. After the ripening reached a certain stage the changes in sugar content were irregular. Irregularities were noted in the moisture content throughout the entire season. Both cold- and hot-pressed juice increased in sugar content and decreased in acid content as the ripening continued, but the changes in the acid content were greater in 1921 than in 1920. Tannin and coloring matter were irregular, but ran higher in the hot-pressed juice than in the cold and higher in the former in 1921 than in 1920.

Analyses for sugars, acids, tannin, and coloring matter are also included on daily samples of factory-run grape juice throughout the entire 1919 season. The results reported show, as in the above samples, a general tendency for sugars to increase and acids to decrease when the grapes are left on the vine, and for irregularity in the content of tannin and coloring matter.

Bulgarian soy beans, A. ZLATAROFF and I. TRIFONOW (*Ztschr. Untersuch. Nahr. u. Genussmtl.*, 44 (1922), No. 4, pp. 214, 215).—The analyses are reported of nine authentic samples of Bulgarian soy beans and, for purposes of comparison, of three samples of the adzuki bean or "Papuda" (*Phaseolus radiatus*).

The soy beans had the following average composition: Moisture 10.91, protein 30.76, fat 18.57, nitrogen-free extract 25.27, crude fiber 3.94, and ash 4.75 per cent. Calculated on the dry basis, the averages for protein, fat, and nitrogen-free extract were 41.24, 20.84, and 28.35 per cent, respectively. The average composition of the adzuki bean was moisture 11.48, protein 18.55, fat 1.50, nitrogen-free extract 59.94, crude fiber 5.57, and ash 2.95 per cent, and on the dry substance protein 20.96, fat 1.71, and nitrogen-free extract 67.70 per cent. The most significant differences in the composition of the soy and adzuki beans are thought to be in the protein and fat content.

Chemical investigation of amylases and related enzymes, H. C. SHERMAN (*Carnegie Inst. Wash. Yearbook* 21 (1922), pp. 344-336).—In this progress report on the investigation previously noted (E. S. R., 47, p. 408), the results are summarized and discussed of the continuation of the experimental study of the effect of amino acids upon the hydrolysis of starch. The various papers, containing the detailed reports of these studies have been noted previously from another source (E. S. R., 48, p. 608). It is stated in conclusion that experiments have been begun on the determination of the isoelectric points of amylases, following the theory that amylases are essential protein substances.

The recovery of volatile solvents, C. S. ROBINSON (*New York: Chem. Catalog Co., Inc.*, 1922, pp. 188, figs. 73).—This volume, which is designed principally for chemical engineers, deals with the fundamental principles involved in solvent recovery, the factors entering into the design of solvent recovery equipment, and the standard form of apparatus used in the more common cases. A list of 218 references to the literature, with brief abstracts of each, is appended, together with a table of vaporization data for various solvents.

Some new sulfonphthalein indicators.—A preliminary note, B. COHEN (*Pub. Health Rpts. [U. S.]*, 38 (1923), No. 5, p. 199).—This is a preliminary note announcing the synthesis of five new sulfonphthalein indicators to supplement the indicator series of Clark and Lubs. One of these, bromocresol green, is said to cover almost perfectly the range of methyl red and is recommended in place of methyl red on account of its greater stability. Bromophenol red and chlorophenol red, covering pH ranges of from 5.4 to 7 and from 5 to 6.6, respectively, are recommended as substitutes for bromocresol purple where dichromatism is a disturbing factor.

The other indicators are meta-cresol purple giving a color change of from red to yellow at a pH range of 0.5 to 2.5 and from yellow to purple at pH 7.6 to 9.2, and bromochlorophenol blue giving a color change of from yellow to blue at pH 3.2 to 4.8.

Measuring the buffer effect, G. LEHMANN (*Biochem. Ztschr.*, 133 (1922), No. 1-3, pp. 30-45, figs. 5).—As a measure of the buffer effect, the author employs the reaction which the buffer solution undergoes when a certain amount of standard HCl or NaOH is added, the degree of buffering being the ratio of added acid or alkali to the change in pH. The indicator method is used to determine the pH values. When two solutions or varying H-ion concentration are mixed in such proportions as to give a calculated pH value, the amounts of the two solutions necessary are inversely proportional to the amounts of HCl or NaOH of equal normality which must be added to the original solution to obtain the desired pH. The buffer value of solutions in which the use of indicators is not possible can be obtained by mixing the solution with a known buffer solution.

Methods for the estimation of small amounts of starch in plant tissues, F. E. DENNY (*Jour. Assoc. Off. Agr. Chem.*, 6 (1922), No. 2, pp. 175-191, fig. 1).—In connection with attempts to measure the progressive reduction in the starch content of the seeds of cantaloups during the ripening period, a study was made of different methods which would be dependable for determining starch in amounts covering a range of from 0 to 1 per cent by steps of about 0.1 per cent.

Unsatisfactory results were obtained with the Official acid hydrolysis method, a modification of the Official diastase method using taka-diastase instead of malt diastase, and the method of Fellenberg in which the starch is dissolved in concentrated calcium chlorid, precipitated as starch iodid, the iodine dissolved, and the starch precipitated by alcohol. From the last-named method the use of calcium chlorid to dissolve the starch was adopted in further work in which various modifications of the method described by Long were tested (E. S. R., 40, p. 114). This method as originally described consists briefly in precipitating the starch as starch iodid with a measured amount of standardized iodine solution and titrating the excess iodine with standard sodium thiosulphate. In a modification of this method the original procedure was reversed, the absorbed rather than the residual iodine being used as a measure of the starch, and in another the starch iodid was successively reprecipitated to obtain a partially purified starch solution. A third method was also tested in which the starch was precipitated with iodine, hydrolyzed with acid, and the dextrose formed tested by the Official method and by the Scales method (E. S. R., 41, p. 412).

These three methods, which are designated, respectively, as the absorbed iodine, the residual iodine, and the reduction methods, are described in detail, and the results are reported of duplicate determinations of cantaloup seed powders by each of these methods, of a comparison of the absorbed iodine method with the other two on cantaloup seed powder, and of the diastase and absorbed iodine methods for determining the starch content of oca tissue (*Oxalis tuberosa*). From the data reported, it is concluded that the absorbed iodine method is the most convenient on account of its rapidity, that the reduction method using the Scales modification is capable of being improved to give greater sensitivity than the other two, and that the residual iodine method is intermediate between the two in both respects.

The determination of the fat content of foods and soaps, J. GROSSFELD (*Ztschr. Untersuch. Nahr. u. Genussmit.*, 44 (1922), No. 4, pp. 193-205).—Disadvantages in the Soxhlet method of fat extraction are discussed briefly, and a new method of determining the fat content of food materials is described which is said to be much more rapid and economical.

The method consists essentially in heating the material under a reflux condenser with a known volume of a fat solvent insoluble in water (trichlorethylene being very suitable for this purpose), evaporating to dryness an aliquot of the solution, and calculating the amount of fat from the proportion $x : a = (x+m) : t$ where x equals the total fat in grams, m the total weight of the solvent, and t the weight of the aliquot used for the evaporation. If 10 gm. of the substance and 100 cc. of the solvent are used, the slight difference in specific gravity of different fats is said to have no appreciable effect on the results. The technique is given of the application of the test to the determination of the fat content of meat and meat products, cheese and milk, soaps, cocoa and chocolate, bread, and pastry. Data are included on the comparative results obtained with a number of these materials by the new method and the Soxhlet method.

Trichlorethylene is also suggested as a suitable reagent for the separation of fats from various materials for quantitative study.

Studies on wheat flour grades.—III, Effect of chlorin bleaching upon the electrolytic resistance and H-ion concentration of water extracts, C. H. BAILEY and A. JOHNSON (*Jour. Assoc. Off. Agr. Chem.*, 6 (1922), No. 1, pp. 63–68).—In continuation of the studies on wheat flour grades (E. S. R., 46, p. 612), an investigation was made of the effect of chlorin bleaching upon the electrolytic resistance, H-ion concentration, and buffer action of flour extracts with a view to ascertaining whether these values could be used to determine the extent of the treatment of the flour with chlorin.

In the first series of studies two samples of natural hard wheat flour were employed, one a patent flour containing 0.43 per cent of ash and the other a clear flour containing 0.84 per cent. Both of these samples had aged for several months. Six portions of each were bleached with the equivalent of 10, 20, 30, 40, 50, and 60 cc. of chlorin per 100 gm. of flour, after which 10 gm. of each were used for electrical conductivity determinations by the method of Bailey and Collatz (E. S. R., 45, p. 615). Another portion of each sample was mixed with water in the proportion of 1 gm. of flour to 5 cc. of water, maintained at 25° C. for 60 minutes, centrifuged, and the H-ion concentration of the supernatant liquid determined electrometrically by the Bailey electrode (E. S. R., 42, p. 412) connected through a calomel half cell with a potentiometer. Gasoline values were also determined, using the method of Winton (E. S. R., 25, p. 507).

With both samples increasing amounts of chlorin resulted in increased specific conductivity and H-ion concentration and decreased gasoline values. It is considered that if the ash content of the flour be known the extent of treatment with chlorin may be estimated by the deviation of the specific conductivity from the normal for flour of the same ash content. The changes in pH values of the patent flour were more marked than with the clear grades on account of the higher buffer action of the latter.

To determine the effect of varying dosages of chlorin upon the buffer index of flour extracts, the method of Bailey and Peterson (E. S. R., 46, p. 612) was used. The results of these tests showed that chlorin bleaching results in a progressive increase in the buffer action of the water extracts. This is thought to be due possibly to the increased hydrolysis of phytin in the presence of HCl resulting from the chlorin.

The above tests were extended further to flours treated in a flour mill on a commercial scale, with results similar to those obtained on the laboratory bleached flours. The commercially bleached samples were then stored for several months to determine the effect of such storage on the various constants.

After two months no appreciable change in conductivity had occurred, and the increase in H-ion concentration was about the same in all cases.

Report on eggs and egg products, H. L. LOURIE (*Jour. Assoc. Off. Agr. Chem.*, 6 (1922), No. 1, pp. 4-13).—This report includes a description of the methods used in the Government laboratories for the analysis of liquid eggs, dried eggs, and egg products.

The question of the analysis of altered milk, A. KLING and A. LASSIEUR (*Ann. Falsif.*, 15 (1922), No. 160-161, pp. 95-101).—The authors discuss, with experimental data illustrating various points brought out, the effect of aging of milk samples upon the various determinations employed to ascertain the purity of the sample. The determinations of extract at 100° C., casein precipitable by acetic acid, and ash are shown to be valueless with altered milk, while the values for total nitrogen and fat are more reliable. In connection with the latter determination, however, it is advised that the acidity of the fat be determined also to ascertain whether during the alteration the glyceric esters have remained intact and are not partially saponified.

In conclusion, the necessity is emphasized of preventing as far as possible any chemical alteration in the milk before analysis. It is considered most essential that the shortest time should elapse between collecting the samples and analyzing them, and that at least one of the samples from each consignment be frozen and kept in this state until analyzed. The bottles for collecting the samples should be kept as aseptic as possible.

A commercial apparatus for the rapid determination of curd and fat in natural and artificial butters, G. FASCETTI (*Nuovi Ann. [Italy] Min. Agr.*, 2 (1922), No. 1, pp. 91-94, fig. 1).—The apparatus described consists of a special form of centrifuge tube, the lower part of which is of a smaller diameter than the upper and is graduated in 0.2 cc. Into this is weighed about 25 gm. of melted butter, to which are then added 5 cc. of amyl alcohol and 1 drop of an alcoholic solution of methylene blue. The tubes are rotated gently to mix the contents, placed in the water bath at from 80 to 90° C. for 5 minutes, and then centrifuged as in the Babcock test, after which they are replaced in the water bath for the same length of time and centrifuged again. From the readings on the graduated scale the volume of curd is determined and the volume of fat calculated by difference.

Solvents for fats, oils, waxes, and resins, H. WOLFF (*Die Lösungsmittel der Fette, Ole, Wachse Harze. Stuttgart: Wiss. Verslags Gesell.*, 1922 pp. [8] + 118, figs. 7).—This volume, which is the first of a series of monographs on fat chemistry edited by K. H. Bauer, deals with the physical properties, chemical composition, and analytical constants of the more important organic solvents for fats, with methods for their quantitative determination. The solvents discussed include hydrocarbons, chlorinated hydrocarbons, alcohols, esters, ketones, ether, and carbon disulphid. An introductory chapter is devoted to general methods of investigation, after which each solvent is considered separately. The three closing chapters deal with the physiological properties of the solvents, a scheme for testing unknown solvents and mixtures of solvents, and a discussion of the saponification and acetyl numbers. Several useful tables are appended, including one summarizing the physical and chemical constants of pure solvents.

The determination of chlorin in organs and foods, S. RUSZNYÁK and D. KELLNER (*Biochem. Ztschr.*, 133 (1922), No. 4-6, pp. 350-354).—The method described, which is said to be suitable either for micro- or macro-determinations, consists essentially in drying the powdered material to constant weight, heating the dry substance for several minutes in a flask with concentrated sul-

phuric acid, diluting the digestion mixture with water, adding a known amount of silver nitrate, reheating, and finally adding potassium permanganate until the color persists after long heating. The solution, after decolorization by heating with small portions of dextrose or oxalic acid, is then ready for titration by the Volhard method.

The technique is described for both micro- and macro-determinations, and data are given on the chlorin content, as thus determined, of various organs and foods.

Practical chemical analysis of blood, V. C. MYERS (*St. Louis: C. V. Mosby Co., 1921, pp. 121, figs. 13*).—This volume consists of a brief discussion of the chemical blood determinations which have been found to be of value in the diagnosis and treatment of disease, together with descriptions of a selected method for each of the determinations. An appendix includes a discussion of the various questions which may arise in the interpretation of the results obtained in the chemical analysis of blood for diagnostic purposes, literature references for other blood determinations of less value, a few quantitative urine methods and an alphabetical list of standard solutions and reagents employed in the various tests.

The reciprocal transformation of creatin and creatinin.—III, The determination of creatinin and creatin in blood serum, A. HAHN and G. MEYER (*Ztschr. Biol., 76 (1922), No. 4-6, pp. 247-256*).—This paper continues the series previously noted (*E. S. R., 45, p. 610*).

For the creatinin determination the protein is precipitated by colloidal iron hydroxid somewhat as in the method of Rona (*E. S. R., 24, p. 514*). For the creatin determination colloidal iron hydroxid, metaphosphoric acid, phosphotungstic acid, and phosphomolybdic acid all proved unsatisfactory as the protein precipitant, but trichloroacetic acid proved a suitable reagent. After removal of the precipitated protein, the excess trichloroacetic acid is neutralized with 30 per cent sodium hydroxid, using a solution of *p*-nitrophenol in 96 per cent alcohol as an indicator, after which the solution is acidified with hydrochloric acid and the technique described in the previous paper is followed.

METEOROLOGY.

The Weather Bureau, G. A. WEBER (*Inst. Govt. Research, Serv. Monog. U. S. Govt. No. 9 (1922), pp. XII+87*).—This is one of the "Service Monographs of the United States Government" prepared by the Institute for Government Research and designed to be of "direct value and assistance in the administration of public affairs" by furnishing the basis for "a comprehensive study of the organization and operations of the National Government. . . .

"These monographs are all prepared according to a uniform plan. They give: First, the history of the establishment and development of the service; second, its functions, described not in general terms but by detailing its specific activities; third, its organization for the handling of these activities; fourth, the character of its plant; fifth, a compilation of or reference to the laws and regulations governing its operations; sixth, financial statements showing its appropriations, expenditures, and other data for a period of years; and, finally, a full bibliography of the sources of information, official and private, bearing on the service and its operations. . . .

"These studies are wholly descriptive in character. No attempt is made in them to subject the conditions described to criticism nor to indicate features in respect to which changes might with advantage be made."

Notes on the Weather Bureau fruit-frost service in southern California, F. D. YOUNG (*Bul. Amer. Met. Soc., 4 (1923), No. 2, pp. 17, 18*).—It is stated

that "at the present time there are eight Weather Bureau employees engaged in this special work in southern California in as many different fruit-frost districts. A total of 204 special temperature stations are in operation, all equipped with standard fruit-region instrument shelters and Weather Bureau minimum thermometers. Thermographs are located at 137 of these stations.

"It is the intention to continue the temperature survey work on this scale, if possible, for five years, at the end of which time an accurate picture of temperature differences on cold nights will be available for use in making local application of minimum temperature forecasts, establishing a basis for an equitable system of frost insurance, and for making accurate estimates of the amount of damage following a killing frost."

British rainfall, 1921 ([*Gt. Brit.*] *Mct. Off., Air Min., Brit. Rainfall Organ.*, 61 (1921), pp. XXIV+300; rev. in *Nature* [London], 111 (1923), No. 2780, p. 181).—This volume summarizes in the usual way the distribution of rain in space and time over the British Isles as recorded during the year by more than 5,000 observers in Great Britain and Ireland. The outstanding special feature of the volume is a discussion of the drought in 1921, "which was more remarkable for persistence than for intensity over short periods, although June and July were probably drier than any two consecutive months in living memory. In England and Wales 1921 was probably the driest year since 1788, and in London it was the driest for at least 148 years." Fluctuations of the annual rainfall and the relation of rainfall to scarlet fever are also subjects of special discussion.

The rainfall of 1922 (*Mct. Mag.* [London], 57 (1923), No. 684, pp. 328, 329).—The relative rainfall distribution of the British Isles, as provisionally computed from 280 out of several thousand records, was as follows: England, 106; Wales, 97; England and Wales, 104; Scotland, 97; Ireland, 94; British Isles, 100. "The local wet areas were thus counterbalanced by the larger areas of slight deficiency, the country as a whole having practically the normal fall for the year."

The drought in Italy during 1921, F. EREDIA (*Compt. Rend. Acad. Sci.* [Paris], 176 (1923), No. 6, pp. 402-404; abs. in *Rev. Sci.* [Paris], 61 (1923), No. 4, p. 125).—This article briefly describes the nature and effects of this drought, which was especially severe from September to December and is attributed to the persistence of low pressure in the Levantine Sea.

Drought and the means of overcoming its evil effects in the Volga region of European Russia, N. TULAIKOV (*Jour. Amer. Soc. Agron.*, 15 (1923), No. 1, pp. 6-15).—It is stated that the climate of this region is "characteristically continental, with a dry, hot, and very long summer, followed by a winter with a limited snowfall and with very severe frosts, falling below -25 to -30° C." Seasons of drought are of common occurrence, and the farmer can never rely upon the occurrence of adequate rainfall in summer. The natural river water supply of the region is insufficient for adequate irrigation. There is a great diversity of soils, but the fertile chernozem is the predominant type. About 93 per cent of the whole area under crops is occupied by cereals which depend entirely upon the rainfall in the spring and early summer.

The principal means of combating drought are diversification of crops, better methods of tillage, development of supplementary irrigation, and more complete utilization of atmospheric moisture which is absorbed by the soil. Among possible ways of utilizing the relatively scanty water supply is by flooding sloping grounds with water derived from melting snows, the latter being secured by means of dams and barriers raised for that purpose.

SOILS—FERTILIZERS.

Soil experiment fields and their value, P. E. BROWN (*Soil Sci.*, 14 (1922), No. 5, pp. 369-376).—The chief purpose of this contribution from the Iowa Experiment Station is to give a little of the historical background for soil experiments, to call attention indirectly to the value of such tests as have been conducted in the past, and to illustrate certain important phases of such work by the results of experiments on Iowa soils. Emphasis is placed upon the importance of care in the planning and laying out of field experiments.

Some considerations on the formation and properties of agricultural soil, G. ROSTER (*Atti R. Accad. Georg.* [Florence], 5, ser., 19 (1922), No. 2-4, pp. 57-80).—The author discusses at some length the mechanical and chemical processes involved in the formation of agricultural soil from the original rocks.

Colloidal clay in agricultural soils, G. DE ANGELIS D'OSSAT (*Staz. Sper. Agr. Ital.*, 54 (1921), No. 4-6, pp. 214-224).—A discussion is given of the factors governing the influence of clay on the properties of agricultural soils and of rocks. These factors include temperature, evaporation, insulation, congelation, and pressure.

Relation between heat of wetting, moisture equivalent, and unfree water, G. J. BOUYOUCOS (*Soil Sci.*, 14 (1922), No. 6, pp. 431-434).—In a contribution from the Michigan Experiment Station, the results of a comparative study made of the relationships existing between heat of wetting, moisture equivalent, and unfree water in soils are presented.

A close and consistent relationship was indicated between the heat of wetting and the unfree water, but not between the heat of wetting and the moisture equivalent nor between the unfree water and the moisture equivalent. The evidence obtained is taken to indicate that the moisture equivalent method does not give a true and absolute equivalent moisture in all of the various soils. Some of the fine-textured and colloidal soils were found to contain considerably more moisture than their true moisture equivalent.

The relation of soil moisture to physiological salt balance for plants, J. W. SHIVE (*Soil Sci.*, 14 (1922), No. 5, pp. 391-411, figs. 6).—This contribution from the New Jersey Experiment Stations deals primarily with soil moisture in relation to the physiological balance of the mineral elements required for plant growth, and presents the results of an experimental study of the growth of young buckwheat plants in soil cultures as affected by different degrees of moisture. Three different degrees of soil moisture were maintained, 30, 60, and 80 per cent, based on the maximum water-retaining capacity of the soil used. Tests were made with 21 different sets of salt proportions of the three salts KH_2PO_4 , $Ca(NO_3)_2$, and $MgSO_4$, supplied to the air-dry soil in the solution form. The solutions were added to the soil in the proper amounts to create the required initial soil moisture. Nine series, each comprising 21 cultures and divided into three groups of three series each, were conducted simultaneously and repeated. The cultures were weighed, and the water loss by transpiration was restored daily throughout the growth period.

The balance of salt proportions which characterized the cultures producing high yields was not materially altered by variations in the degrees of soil moisture when the total osmotic concentration values of the solutions added to the soil cultures to produce the required initial soil moisture were approximately constant. In general the salt proportions which produced high yields of tops with the lowest degree of soil moisture gave high yields also with the medium and the highest degrees of moisture in the respective series.

Pronounced shifting of the balance of salt proportions characterizing the cultures which produced high yields occurred only with marked variations in the total concentration of the solutions added to the soil.

The yield differences resulting from variations in the degrees of soil moisture were quite as pronounced as those which may be attributed to variations in the proportions of the fertilizer constituents with constant soil moisture. The retarding influence of unfavorable soil moisture conditions upon the rate of growth of the plants could not be counteracted by fertilizer treatment alone. High yields from cultures with medium soil moisture (60 per cent on the basis of the maximum water-holding capacity of the soil) were always greatly superior to the corresponding yields from the cultures with either high or low soil moisture, regardless of experimental methods or conditions to which the cultures were subjected.

The salts comprised in a fertilizer mixture could not be efficiently utilized by the plants under unfavorable moisture conditions. The maximum plant-producing value of any fertilizer mixture could only be attained when the moisture conditions of the substratum were at the optimum for plant growth.

Studies and researches on soil reaction, U. PRATOLONGO (*Gior. Chim. Indus. ed. Appl.*, 4 (1922), No. 11, pp. 517-521).—This is a preliminary note on the subject, summarizing briefly a series of researches by the author and others on soil acidity and alkalinity with special reference to Italian soils. Attention is drawn to the importance of the relation between the production of acidity in soils and the phenomena of oxidation and reduction in determining the origin and nature of the soil reaction.

A scheme of soil classification with reference to reaction and the relation of reaction to bacterial flora and vegetation is outlined briefly, as an aid and check in determining the acidity or alkalinity of a soil by analytical methods. The relation of the chlorosis-producing power of a soil to its degree of alkalinity is also mentioned, and the influence of complexity of alkalinity and the presence of an abundance of carbonates on the utility of a soil is discussed. Information is also given on the cultural treatment of acid or alkaline soils.

Reaction of Italian soils, U. PRATOLONGO (*Italia Agr.*, 59 (1922), No. 12, pp. 413-422, figs. 4).—This is a contribution from the Scuola Superiore di Agricoltura of Milan summarizing a series of studies on the acidity and alkalinity of Italian soils and methods for their classification, utilization, and treatment, and presenting substantially the same views as in the above.

The hydrogen-ion concentrations of some Indian soils and plant juices, W. R. G. ATKINS (*Agr. Research Inst., Pusa, Bul.* 136 (1922), pp. 12).—Determinations of the H-ion concentrations of a few common Indian crop plants and of certain Indian soils are presented and discussed. In the plants pH values of from 6.8, or neutrality, for certain roots up to as high an acidity as that corresponding to a pH value of 1.4 for an unripe berry were found.

The soil reactions varied from pH 8.9 for the calcareous silt of Bihar to pH 5.3 for a black peaty soil from Shillong. Certain Assam soils of a sandy nature were found to be acid up to a pH value of 5.4. This appeared to be due to the presence of traces of sulphuric acid derived from the oxidation of sulphur from iron pyrites, which is distributed throughout them in small grains. This acidity is suggested as the cause of their high content of available phosphate.

Indications were obtained that the reaction even of the highly calcareous silt of Bihar may be somewhat modified by manurial treatment, quite apart from any attempt to an obvious alteration. Thus, treatment with ammonium sulphate, potassium sulphate, or a mixture of the two, rendered the soil less alkaline but only slightly so, the reduction being about pH 0.4. A further

reduction took place in water-logged soil through the accumulation of carbonic acid.

It was shown that calcium sulphate will, by precipitation of calcium carbonate, reduce the alkalinity of a sodium carbonate solution from pH 10 or over to pH 8. The latter is a limit suitable for plant life, whereas the former is not. This is considered to explain the value of the use of gypsum on black alkali lands.

Measuring soil toxicity, acidity, and basicity, R. H. CARR (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 10, pp. 931-933, fig. 1).—In a contribution from the Indiana Experiment Station, studies are reported which indicate that some iron and aluminum are present in an acid soil in an easily soluble condition and can be extracted by salts which are nearly neutral. The colored ferric thiocyanate changed to a colorless compound on the addition of a base, and the change took place at a H-ion concentration corresponding to a pH value of 5.5. The addition of a few drops of an alcoholic solution of logwood to the potassium thiocyanate extract from the soil indicated by the depth of the blue color the relative amount of aluminum in solution.

It was found that the lime requirement of soils as determined by this method corresponds closely to that determined by the Velth method, and seems to lend itself to the determination of either the acid or basic condition of the soil. It is stated that the soluble iron and aluminum found in soils have been helpful in pointing to a source of some of the plant disease troubles.

Soil survey of Washington County, Oreg., E. B. WATSON ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils*, 1919, pp. 51, pl. 1, fig. 1, map 1).—This survey, made in cooperation with the Oregon Experiment Station, deals with the soils of an area of 467,840 acres in northwestern Oregon, which includes the valley of the Tualatin River between the Coast Range and Cascade Mountains and lies within the Pacific coast soil region. About one-fourth of the area is said to consist of comparatively level valley and the rest of hills or low mountains. The Tualatin River cares for the drainage of most of the county. It is stated that, while the natural surface drainage for most of the main valley has been well established, there are a few flats and basins to which the drainage system has not extended in its normal development.

The soils of the area are grouped as residual, old valley-filling, and recent-alluvial. Including rough mountainous land and muck and peat, 22 soil types of 13 series are mapped, of which rough mountainous land, Willamette loam, and Melbourne loam cover 37.6, 14.1, and 12.3 per cent of the area, respectively.

Some Transvaal soils, T. D. HALL (*Union So. Africa Dept. Agr. Bul.* 5 (1922), pp. 36).—This study is in two parts.

I. Investigations on some highly calcareous soils.—Chemical, biological, and cropping studies of the soils of an area of irrigated wheat lands in the Marico District of South Africa, including sandy to clayey red loam, gray highly calcareous loam, and dark brown to black calcareous clay loam are reported.

All the soils were well supplied with lime but were apparently deficient in phosphorus and organic matter. The dark brown clay loam was found to be also deficient in potash. Nitrification was satisfactory in all three soils, especially in the calcareous gray loam. The soil with the lowest water-holding capacity showed the poorest nitrification. The water-holding capacity of the highly calcareous soils was particularly good.

II. Soils of the eastern Transvaal low veld.—The results of mechanical, chemical, and biological studies of samples of soils from the Barberton District of the eastern Transvaal region are reported.

The arable soils of the greater portion of the district are said to be chiefly of granitic origin, and the two main types appear to be gray, coarse, sandy

loam and red loam. Some of these soils are said to be poorly drained, and many are deficient in organic matter and have a low water-holding capacity. The chief mineral deficiency is said to be in phosphates. Some of the soils are also deficient in available and total potash. Nitrification was found to be fair in these soils and in some cases very good, but it is stated that the total nitrogen content should be increased. General recommendations for the management of these soils are included.

Report on a soil survey of zone No. 1 (Garbieh [Egypt]), 1921, F. HUGHES (*Egypt Min. Agr., Tech. and Sci. Serv. Bul. 21 (1922), pp. 11, pl. 1, figs. 2*).—The results of a preliminary survey made of the soils of an area of approximately 30,000 feddans (31,140 acres) lying between Fareshkur and Kafr-el-Wastani and bounded on the north by Kafr-el-Battikh drain in Egypt are reported.

A study was made of the content of total soluble salts, sodium chlorid, and sodium carbonate, and of the mechanical composition of some 500 samples taken at a depth of some 3 meters (9.84 ft.). The amount of soluble salts found was not excessive, and sodium carbonate was rarely encountered. It is thought that owing to the permeability of the surface soil, the salt should be easily washed out if suitable drainage is provided, especially in view of the almost entire absence of carbonate. The subsoil was found to be of an impermeable nature, and reclamation on similar land proved successful.

It is concluded that the chemical composition of the soil does not differ from the average composition of Nile soils except that the lime content is generally low. Potash and phosphoric acid were found to be present in average quantities. A suggestion as to the origin of the soil of this area is advanced.

The basis of Egyptian agriculture and its relation to the decline in the average yield per feddan of cotton, E. M. TAYLOR and A. C. BURNS (*Egypt Min. Agr., Tech. and Sci. Serv. Bul. 25 (1922), pp. VI+70, pls. 5*).—Studies of the history of the development of perennial irrigation and the modifications it has induced in Egyptian agriculture are described. These included an extensive biological study of Egyptian soils.

The conclusion is drawn that the basis of Egyptian agriculture under the basin system of irrigation was the sharāqi period, or period of compulsory fallow. The authors attribute the maintenance of the fertility of the soil to this fallow. The development of perennial irrigation has resulted in a change of the basis of Egyptian agriculture from sharāqi to its antithesis, a maximum summer water supply. It is emphasized that the development of perennial irrigation has created a new and not intensified an old system of agriculture.

The results of soil studies led to the conclusion that the fertilizing properties of Nile silt have been considerably exaggerated. This conclusion is supported by the similarity in composition of Nile silt and of the soil, the proved absence of readily nitrifiable matter, and the lack of response of the cotton crop to fertilizers in general. It appears, therefore, that the deposition of Nile silt upon the land was probably not the main factor concerned in the maintenance of the fertility of Egyptian soils. The sharāqi period was typical of the system of agriculture in the large cotton-producing provinces under perennial irrigation until 1898. Since that date sharāqi has no longer been typical of the agricultural practice of certain localities, which coincides with the beginning of the period of decreasing yield.

It was demonstrated in the laboratory that the heating of the soil to a temperature attained during the sharāqi period increased the subsequent production of nitrate, resulting in an increased crop, as evidenced by pot experiments. The biological studies showed that nitrifying bacteria capable of withstanding

a temperature of 58° C. exist in Egyptian soils, hence there is no check to nitrification after partial sterilization.

The fact that protozoa are introduced into the soil by irrigation and that suitable conditions for their development are induced in poorly drained soils is taken to indicate that the protozoa are the limiting factor in crop production. The analogy between "sewage sickness" and the soil conditions in certain Egyptian localities led the authors to define the condition of the soil resulting from perennial irrigation as "irrigation sickness."

It is shown that the decline in yield of cotton can be directly attributed to the factor limiting the bacterial activity and the formation of the optimum soil solution. The intensification of the sharâqi effect by means of plowing during the summer period is suggested as a means of completely suppressing the protozoa in the soil and restoring its crop-producing power.

A bibliography is appended.

Hardpan in the Apulian soils and its origin. Researches on soil chemistry in the Bari district, A. DE DOMINICIS (*Ann. R. Scuola Super. Agr. Portici*, 2. ser., 15 (1919), Art. 15, pp. 1-39, fig. 1; abs. in *Internatl. Inst. Agr. [Rome]*, *Internatl. Rev. Sci. and Pract. Agr.*, 11 (1920), No. 3, pp. 292, 293).—This is a contribution from the Royal School of Agriculture at Portici, Italy. It reports studies of the physics and chemistry of soils and well waters of the Bari district and of the movement of water in soils as influenced by hardpan.

The hard calcareous crust or hardpan runs uninterruptedly between the surface and subsoils of the region. The subsoil is highly pervious, but its water-retaining capacity is low for crops other than trees. The rain water, being unable to penetrate the hardpan, runs off over this impervious layer, carrying away part of the top soil with it. A considerable amount of data is presented on the origin and composition of the hardpan, and the problem of its removal is discussed.

Agricultural and industrial opening of German moor soils before and after the war, H. BOERGER (*Landwirtschaftliche und Industrielle Erschliessung der Deutschen Moorböden vor und nach dem Kriege*. Münster (Westph.): Franz Coppenrath, 1919, pp. 48).—This publication describes the general character, geology, and botanical structure of the moors of Germany, and deals at some length with the agricultural and industrial utilization of the moor soils, taking up such questions as the cultivation and fertilization of upland and lowland moors and the industrial utilization of peat.

Other sections deal with the colonization and settlement of moor lands, with particular reference to small and large scale operations and the questions of financing and labor.

Peats and other vegetable deposits of Madagascar, P. DE LA BATHIE (*Bul. Écon. Madagascar*, 18 (1921), III, No. 31, pp. 179-187).—This is a brief description of the origin, composition, and botanical characteristics of the peat deposits of the island of Madagascar. These deposits are divided into those which have been formed in place and those formed from transported vegetable matter. In the botanical discussion attention is drawn to the so-called dominating plant species which furnished the most of the material from which the peat was found, as distinguished from the so-called accessory plant species which contributed only a small amount of material.

The dispersoid chemistry of peat, I-III (*Kolloid Ztschr.*, 29 (1921), No. 6, pp. 316-329; 30 (1922), Nos. 2, pp. 119-133, figs. 7; 3, pp. 187-198, figs. 4; 31 (1922), No. 4, pp. 197-200, figs. 5).—This series of studies of the colloidal chemistry of peat soils was apparently planned to throw light on the manner of combination of water in them and on methods by which it may be removed,

as a basis for studies of the drainage of this and similar types of soils. The studies are presented in three parts.

I. *Nature of the fixation of water in peat*, W. Ostwald.—A theoretical study of the manner in which water is combined in soils, especially peat, and of the stability of the different forms of combination is presented. The question is considered to be one of fundamental importance with reference to the drainage of peat soils.

It is concluded that water is fixed in peat soils as occluded or absorbed water, capillary water, water in colloidal compounds, osmotically fixed water, and chemically combined water. The most unstable fixation is said to be that of the occluded water. The capillary water is more firmly fixed in peat soils, especially in the solid raw material. The colloidal gels of peat which exist in intact plant cells are considered to take up water by osmotic pressure. Apparently this power is lost when the plant cells die and decompose. The manner of combination of chemically combined water varies according to the individual chemical composition of the matter with which it is combined.

With reference to the drainage of peat soils it is concluded that the colloidal water is the most important.

II. *The dispersoid chemical changes of peat under steam pressure*, W. Ostwald and P. Wolski.—In a second contribution to the subject studies on technical methods for removing the water from peat are described in which the steam pressure method of ten Bosch was especially dealt with as a means for separating the colloiddally combined water. It was found that this process dissolved some of the gels of peat and coagulated others, with the result that their water content could be separated.

III. *Dehydration of peat at temperatures below 100° C.*, W. Ostwald and A. Wolf.—Studies are reported which showed that heating of peat for several hours at 100° leads to a spontaneous delivery of water which is accompanied by dispersoid and colloid chemical changes of qualitatively the same kind as are observed when using higher temperatures and pressure.

Determination of degree of peat formation, V. GORBENKO (*Izv. Nauch. Eksp. Torf. Inst, Moskva (Mitt. Wiss. Expt. Torfinst., Moskau), No. 2 (1922), pp. 104-121*).—A comparison of the Keppeler and von Fellitzen methods for determining the degree of decomposition of peat is described, leading to the conclusion that the former method is complicated and not very accurate.

A study of the causes of frost occurrence in muck soils, G. BOUYOUKOS and M. M. MCCOOL (*Soil Sci., 14 (1922), No. 5, pp. 383-389*).—This is a preliminary report on an investigation in progress at the Michigan Experiment Station on the causes of frost occurrence in muck soils. It is said to be a general observation that when a frost occurs during the growing season plants grown on muck and peat soils may be completely killed, while the same plants grown on mineral soils adjacent to and even on the same level may not be at all touched by the frost.

The results obtained seemed to show that heat conductivity is the predominant factor responsible for this difference in frost occurrence. The mineral soils are good conductors of heat, while the organic soils are comparatively poor conductors. The mineral soils, therefore, allow the heat which has been accumulated at various depths during the day to travel to the surface at a greater speed than in the case of the organic soils. The result is that the surface of the mineral soils is kept at a higher temperature, while that of the organic soils is allowed to become excessively cold, even though their temperature at the lower depths is much higher than that of the mineral soils. The air above the mineral soils, therefore, is warmed at a correspondingly greater degree than that above the organic soils, and on a night when not too heavy a drop occurs

the mineral soils are able to prevent a frost, while on the organic soils frost occurs.

Microbiological analysis of soil as an index of soil fertility.—III, Influence of fertilization upon numbers of microorganisms in the soil, S. A. WAKSMAN (*Soil Sci.*, 14 (1922), No. 5, pp. 321-346, figs. 2).—This third contribution from the New Jersey Experiment Stations on the subject (E. S. R., 48, p. 719) deals with the influence of soil fertilization upon the number of microorganisms in soil. The results presented in the two previous papers dealing principally with methods of making microbiological analyses are summarized.

By these methods and precautions it was found that potassium salt and phosphates stimulated the development of microorganisms in a sandy loam soil not very rich in organic matter. Stimulation was more marked in the presence of lime than in its absence. The addition of lime resulted in a decrease in the number of fungi and an increase in numbers of bacteria and actinomycetes. Sodium nitrate stimulated the development of bacteria and actinomycetes but not of fungi. Ammonium sulphate, making the soil distinctly acid, stimulated the development of fungi, with a decided decrease in the numbers of bacteria and particularly actinomycetes. Where lime was used together with the ammonium sulphate, the stimulating influence was equal to that of sodium nitrate. Manure exerted a decided stimulating effect upon all groups of microorganisms developing on the plate.

Crop production ran nearly parallel in this particular soil with the numbers of microorganisms in the soil developing on the plate. It is concluded in general that "the number of microorganisms in the soil, when determinations are carried out under proper conditions with due allowance for the variability of the methods used and soils, can serve as one function for measuring the bacteriological condition of the soil and crop production."

Microorganisms concerned in the oxidation of sulphur in the soil, IV, V, S. A. WAKSMAN (*Jour. Bact.*, 7 (1922), No. 6, pp. 605-616).—In continuation of a series of studies on the subject (E. S. R., 47, p. 621), two papers are presented.

IV. A solid medium for the isolation and cultivation of *Thiobacillus thiooxidans*.—The results of studies on liquid and solid media for the isolation and cultivation of *T. thiooxidans* are briefly reported.

It was found that Beijerinck's thiosulphate medium when properly modified provided a solid medium favorable for the growth of the organism. The modification consisted in the elimination of sodium bicarbonate, changing the di-basic potassium salt to the monobasic form, and the addition of calcium chlorid. The composition of the medium is as follows: $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$, 5 gm.; KH_2PO_4 , 3 gm.; NH_4Cl , 0.1 gm.; MgCl_2 , 0.1 gm.; CaCl_2 , 0.25 gm.; agar, 20 gm.; and distilled water, 1,000 cc.

V. Bacteria oxidizing sulphur under acid and alkaline conditions.—These studies showed that at least two organisms take part in the oxidation of sulphur in soil. "While in acid soils *T. thiooxidans* will rapidly oxidize the elementary sulphur, in alkali soils, particularly black alkali soils, still another organism, *Thiobacillus B.*, similar to *T. thioparvus* of Beijerinck, takes an active part in this process. *T. thiooxidans* is usually not present in common cultivated soils, but is found abundantly in soils previously treated with sulphur. *Thiobacillus B.* is commonly present in cultivated soils. By the interaction of the two organisms, sulphur can be oxidized at reactions ranging from pH=9.8 to 1."

Information is also briefly presented on the taxonomic position of the colorless sulphur-oxidizing organisms not accumulating sulphur within their cells.

Influence of humus on the sensitivity of *Azotobacter chroococcum* toward boron, J. VOICU (*Compt. Rend. Acad. Sci. [Paris]*, 175 (1922), No. 6, pp.

317-319; *abs. in Jour. Soc. Chem. Indus.*, 41 (1922), No. 18, p. 723A).—Studies in culture solutions of the influence of boric acid on the nitrogen-fixing powers of *A. chroococcum* as affected by the presence or absence of humus are reported.

In the absence of humus the presence of boric acid in varying amounts had little influence upon the rate of nitrogen fixation. As humus was added, both the nitrogen fixation and the toxicity of the boric acid increased. As the boric acid and humus additions were enlarged the toxicity of the former gradually overcame the stimulating influence of the latter, and the actual amount of nitrogen fixed was reduced markedly.

Researches on protozoa of soils and water, A. COPPA (*Staz. Sper. Agr. Ital.*, 54 (1921), No. 4-6, pp. 181-212, figs. 5).—This is a study of the occurrence, distribution, and types of protozoa in soils and water and of the conditions governing their growth and activity.

In laboratory studies 62 species of protozoa were isolated, all of which were capable of encystment. Heat and nutrient material were found to be the main factors promoting growth. The geological nature of the soil had a certain influence on protozoan life, soils prevalently siliceous being more favorable than calcareous soils.

Individual fertilizer practices apparently exercised no particular action upon protistological fauna. Neither temperature nor osmotic pressure under different atmospheric conditions and in solutions of single fertilizing salts exercised sufficient influence to give characteristic and diverse views of protozoa in different states of occurrence and in different types of soil. Characteristic indications were evident only in rice field soils. Moisture appeared to be the most important factor in the growth of soil protozoa. In fact 17 species other than those found in rice field soils were found in potable waters.

Protozoa were found to be transported in soils principally by the movement of water. The maximum development of protozoa in water occurred in June and the minimum in October. Of the species classified in general, 35 are as common in water as in soil. The rhizopods apparently are in the majority. The majority of the water forms observed in soil appeared to live a long period of the year in water, as in rice fields or in sewage filter beds. In general there was no difference in the time of appearance of the same species under different conditions.

Productive soils, W. W. WEIR (*Philadelphia and London: J. B. Lippincott Co.*, 1922, 2. ed., *enl.*, pp. XV+317, figs. 202).—This is the second enlarged edition of this book (E. S. R., 43, p. 719), dealing with the fundamentals of successful soil management.

Soil culture in the light of present needs, T. REMY (*Veröffentl. Landw. Kammer Rheinprov.*, No. 2 (1922), pp. 1-43).—Considerable information on the practical management of German soils in order to increase crop yields, including cultivation, fertilization, rotation, and general cropping practices, is presented in this part of this publication.

Soil cultivation studies, A. N. J. BEETS (*Proefsta. Vorstenland. Tabak [Dutch East India]*, *Meded.* 45 (1922), pp. 76, figs. 9).—Experiments conducted on heavy and light soils to compare the results of cultivation by the so-called gebroessan, kullen, and patjollen methods on tobacco crops are reported.

In the gebroessan treatment the plats of soil are divided into parallel strips 30 by 3 ft. By means of a patjol, an implement similar to a hoe, the top 5 or 6 in. of soil is removed and the subsoil cultivated to a depth of 9 in. The top soil is then replaced over the subsoil, except that the top soil from each strip is placed over the cultivated subsoil of the preceding strip. In the kullen treatment the plats are laid off in similar parallel strips and the top 6 in. of soil removed from every second strip and placed upon the inter-

vening strips. The subsoil is then cultivated to a depth of 9 in. and allowed to dry for the proper period of time, corresponding to the wetness of the subsoil. The top soil is then replaced on the subsoil of those strips from whence it was taken, and the intermediate strips are similarly treated. After an entire plat has been so treated and dried it is leveled.

A comparison on heavy clay soil of gebroessan, kuilen exposed for long and short periods, and kuilen filled in immediately after the subsoil was treated showed that kuilen is in general a better treatment than gebroessan for such soils. In wet years better results were obtained by long exposure of kuilen treatment, while in dry years short exposure or direct filling in gave the best results.

The patjollen treatment consists of cultivating the soil with a patjol without dividing it into strips or treating the subsoil and top soil separately. A study of several years' duration indicated that for the lighter soils gebroessan treatment is to be preferred to either patjollen or kuilen.

Experiments on soil covered with volcanic sand to compare plowing followed by gebroessan with plowing followed by kuilen indicated that the latter process gave the best results on long cultivated soils. On new heavy soils the former treatment was best, owing to the fact that in the kuilen treatment too much of the raw subsoil was brought to the surface.

Experiments to determine the influence of removing the volcanic sand altogether and of digging it under the top soil showed that the latter process gave the better results.

Utilization of the waste heat of hot waste water from the cooling wells of steam power plants for the heating of soil to promote the growth of vegetables, H. BALCKE (*Tech. Landw.*, 3 (1922), No. 4, pp. 89-92, figs. 6).—Experiments on the artificial heating of vegetable garden soil by means of the waste hot water from steam power plants are briefly described. A marked improvement was observed in the growth of the vegetables in the heated over that in the unheated soils.

Collected leaflets on manures and manuring (London: Min. Agr. and Fisheries 1922, pp. 111, figs. 6).—This publication summarizes a number of leaflets which have been published at various times by the British Ministry of Agriculture and Fisheries on manures, fertilizers, and lime and on their rational uses, with particular reference to British conditions.

Possibilities in the use and preparation of concentrated fertilizers, W. H. ROSS (*Amer. Fert.* 57 (1922), No. 10, pp. 39, 40, 63, 64).—In a contribution from the U. S. D. A. Bureau of Soils, an argument is presented for more extensive research into the use of concentrated fertilizers. Attention is drawn to some of the concentrated fertilizers, such as ammonium phosphate and ammonium nitrate, which are being yielded by modern processes. The reduction in expense of handling and transporting fertilizers of high concentration is also emphasized.

Forty years' results with fertilizers, F. D. GARDNER, C. F. NOLL, and R. D. LEWIS (*Pennsylvania Sta. Bul.* 175 (1922), pp. 23, figs. 10).—A summary is presented of the results obtained from experiments begun in 1881 with commercial fertilizers, barnyard manure, lime, and land plaster for a period of 40 years (*E. S. R.*, 37, p. 626).

This experiment was begun on land in a rather high state of fertility, but the treatments giving the best results have hardly more than maintained the yields. The average yield of the untreated plats in the last 8 years has been only 57.6 per cent as great as in the first 8. These untreated plats have apparently reached a condition where the yields will remain practically the same except as influenced by seasonal conditions.

Phosphoric acid is the first limiting factor in this soil, and until this element is supplied nitrogen and potash give little increase in yields. Ground bone has seemed but slightly, if any, better as a source of phosphoric acid than dissolved bone black. Potash alone has increased yields only slightly, but when added to phosphoric acid has given an increase of 29.6 per cent over phosphoric acid alone. Potash has been applied only at the rate of 100 lbs. of potash, or 200 lbs. of potassium chlorid on alternate years. This is a much higher rate than can be recommended for the crops grown in this rotation, and the authors believe that half this quantity would have given as good yields. Phosphoric acid and potash without any nitrogen have given a greater net return than any of the combinations including nitrogen, and have practically maintained the fertility for 40 years. This is in a rotation including clover once in 4 years.

Nitrogen at the rate of 24 lbs. per acre has not given profitable increases in the yield of crops when used alone or in any fertilizer combination. Increasing the rate from 24 to 48 and 72 lbs. in complete fertilizers caused increases in yields, except where ammonium sulphate was applied, but not enough to offset the additional cost of the fertilizer. Sodium nitrate has slightly outyielded dried blood and very much outyielded ammonium sulphate where the latter was applied at the highest rate. The low yields which have accompanied the use of heavy applications of ammonium sulphate have been due to the soil acidity induced by this fertilizer.

Complete fertilizers, except where heavy applications of ammonium sulphate have been used, maintained the yields approximately as well as manure. Manure has been applied at rates of 6, 8, and 10 tons. The increase in yields from applying more than 6 tons has not been in proportion to the amounts of manure applied, indicating the economy of light applications.

Burnt lime at the rate of 2 tons per acre once in 4 years and ground limestone at the same rate once in 2 years on plats receiving no commercial fertilizer or manure have each caused a slight increase in yield and in crop value. If each is compared with its nearest check the differences in the increases in yields from these two forms of lime are insignificant. Burnt lime applied with 6 tons of manure has caused a larger increase than where used alone. Applications of 320 lbs. of land plaster on alternate years on plats receiving nothing else have not appreciably increased the yields.

A rational system of fertilization for the residual soils of Pennsylvania is suggested.

The *sébach* of the "koms" or "*sébach koufri*" [in Egypt], V. M. MOSSÉRI (*Bul. Inst. Égypte* 3 (1920-21), pp. 75-92).—The results of an investigation into the fertilizing value of the *sébach* or manure from some 250 of the koms or mounds of rubbish, which gradually accumulate near Egyptian towns and villages during the course of destruction and reconstruction through the centuries, are reported.

The *sébach* or *koufri*, as it is sometimes called, is a pulverulent substance used for manuring cultivated soils. It consists mainly of rubbish and in general has a low content of fertilizing constituents. This was found to vary with the locality, however, and in different strata of the same mound. The use of this material was found to result usually in some perceptible effect, either favorable or unfavorable on the soil.

It is concluded that the *koufri* may be profitably used on normal alluvial soils primarily as a nitrogenous fertilizer owing to its nitrate content, which was found to vary from traces to 3.5 per cent. The content of ammoniacal nitrogen is present in negligible quantities, and the organic nitrogen is also disregarded owing to doubt as to its subsequent nitrification. It is further con-

cluded that koufri may be used as a source of nitrogen, phosphoric acid, and potash for all other Egyptian soils, but that these fertility constituents are not present in the quantities or proportions required for a balanced complete fertilizer. It is usually necessary to supplement the koufri with a nitrogenous fertilizer. Phosphoric acid soluble in ammonium citrate was found in koufri in amounts up to 1.3 per cent, and potash soluble in 1 per cent citric acid was found in amounts varying from 0.096 to 2.28 per cent.

Koufri always contains soluble salts in varying amounts, and it is considered advisable to determine their nature and amount before applying the koufri to some soils.

Nitrification of filter press cake in the acid red clay soils of Porto Rico. J. H. RAMÍREZ (*La Planter*, 70 (1923), No. 3, pp. 48-50, figs. 2).—Studies conducted at the Porto Rico Experiment Station on the nitrification of filter press cake in acid red-clay soils are reported.

Laboratory experiments on the nitrification of filter press cake inoculated with soil infusion and without inoculation showed that 15 tons of cake, which contained in all 726 lbs. of total nitrogen, did not at any time during a 6-month period produce more than 62 lbs. of nitric nitrogen. Of these 726 lbs. of total nitrogen, 9 lbs. were lost by denitrification.

Nitrification tests of the cake in soil where the cake was added at the rate of 15 tons per acre indicated that the soil contained during the first four months more nitric nitrogen than the soil to which the cake was applied at rates of 25 and 50 tons per acre. The excess of nitric nitrogen contained in the soil receiving the two higher applications over that contained in the first soil during the latter part of the experiment was not proportional to the amount of filter press cake applied in excess of 15 tons.

Analyses of filter press cake showed that it contains more plant nutrients than stable manure. It is concluded that applications of from 15 to 25 tons of the cake per acre will give the best results on this acid red-clay soil, and that during the third month after application an increase in nitric nitrogen will take place.

Canadian experiments with nitrite fertilizer (*Chem. and Metall. Engin.*, 28 (1923), No. 7, p. 310).—Greenhouse experiments on the use of sodium nitrite on oats are said to have shown no evidence of injury either to the germinating seedling or to the mature plant at any stage when the nitrite was applied at the rates of 150 and 300 lbs. per acre. The heavier applications gave the better results. These results are said to have been confirmed by field tests. Sodium nitrite apparently injured corn, beans, and peas, many of these crops failing to germinate. There was less evidence of injury to potatoes.

[**New nitrogenous fertilizer studies**] (*Arch. Suikerindus. Nederland. Indië*, 30 (1922), No. 50, pp. 957-960).—Experiments with garden and field crops on light and heavy clay and sand soils gave results indicating that ammonium sulphate nitrate, urea, ammonium chlorid, and synthetic or neutral ammonium sulphate are as effective as ordinary ammonium sulphate as sources of nitrogen. Data on experiments with boengkil, sodium nitrate, and ammonium phosphate are also briefly presented.

Ammonium chlorid and nitrogenous fertilizers, L. MAUME (*Ann. École Natl. Agr. Montpellier. n. ser.*, 17 [1922], No. 3, pp. 246-250).—Plat experiments with wheat to compare ammonium chlorid with six other nitrogenous fertilizers as a source of nitrogen are briefly reported. The results showed that the ammonium chlorid compared quite favorably with ammonium sulphate, ammonium nitrate, and calcium nitrate. The poorest results were given by calcium cyanamid.

Advantage of the use and production of ammonium bicarbonate for fertilizer purposes, W. GLUUN (*Chem. Ztg.*, 46 (1922), Nos. 92, pp. 693-697; 95, pp. 715-717, fig. 1).—A considerable amount of data on the value of ammonium bicarbonate as a nitrogenous fertilizer is summarized. This material is said to be superior to the sulphate and chlorid of ammonium in that it does not have the tendency to produce a condition of strong mineral acidity in the soil, and in addition its mechanical condition permits easy and uniform distribution. It has the disadvantage of being unstable, and different methods for preventing abnormal losses of ammonia during handling and use are outlined. The manufacture of ammonium bicarbonate is also discussed, with particular reference to the advantage with which this may be taken up by the coke industry.

Studies of the availability of organic nitrogenous compounds, I. C. S. ROBINSON, O. B. WINTER, and E. J. MILLER (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 10, pp. 933-936, fig. 1).—Studies conducted at the Michigan Experiment Station to determine whether or not any relation exists between the chemical composition of certain organic nitrogenous compounds and the availability of their nitrogen for plant nutrition are reported.

It is conceded that inorganic compounds of ammonia and nitric acid constitute a class of immediately available material. On the assumption that the ammonifying power as distinguished from the hydrolyzing power of the alkaline permanganate solution used in the studies is comparable to the action of soil agents, all amino nitrogen present in the form of α -amino acids and a portion of that nitrogen present as acid amids are added to the available class of nitrogenous compounds.

Attention is also drawn to another class of compounds which is called the potentially available class. It includes such substances as may be converted into members of the above classes, and consists of a portion of the acid amids, the peptids which can be hydrolyzed to amino acids, and primary and secondary amines. It is considered probable that the peptids form the great bulk of this class so far as ordinary fertilizing materials are concerned.

Phosphoric acid and nitrogen fertilization questions with reference to the new "fertilization system" of Acreboe and Wrangell, P. WAGNER (*Deut. Landw. Presse*, 49 (1922), Nos. 52, pp. 355, 356; 53-54, pp. 361, 362; 55-56, pp. 369, 370; 57-58, pp. 379, 380; 59, p. 386; 60, pp. 392, 393; 61, pp. 399, 400).—The author reviews the theories advanced by Acreboe and Wrangell regarding the substitution of potassic-nitrogenous fertilization for potassic-phosphatic fertilization, especially on leguminous and hay crops on German soils, and summarizes the results of a number of experiments with different root, hay, leguminous, and other crops conducted on different soils at several German experiment stations to substantiate his conclusion that the high price of phosphoric acid is not sufficient justification for discontinuing phosphatic fertilization of crops.

It is further concluded that legumes are not capable of assimilating sufficient phosphoric acid from insoluble phosphates to make phosphatic fertilization unnecessary, and that such assimilating power of legumes for insoluble phosphates is not appreciably increased by heavy nitrogen fertilization.

The results summarized are also taken to indicate that fertilization with nitrogen alone will not produce unusual yields of legumes or meadow crops, and that heavy potassic-nitrogenous fertilization will not cause meadow crops to become so saturated with soil phosphorus that phosphatic fertilization is unnecessary. On the contrary, the results indicate that continuous fertilization with potash and nitrogen alone without phosphorus causes a gradual depression of the clovers and grasses, apparently owing to a deficiency in phosphorus.

It is further brought out that the sulphuric acid of ammonium sulphate will not make sufficient of the soil phosphorus available in ordinary agricultural practice to make phosphatic fertilization unnecessary.

The story of phosphate rock (*Amer. Fert.*, 57 (1922), No. 10, pp. 23-38d, figs. 25).—This is a detailed description and discussion of the occurrence and mining of phosphate rock and of its uses in manufacture, particularly of fertilizer. Considerable statistical data are included.

Phosphate beds of the islands of Juan-de-Nova, Europa, and Barren: Their agricultural value, ERIART (*Bul. Econ. Madagascar*, 18 (1921), III, No. 31, pp. 177, 178, pls. 2).—Analyses of phosphates from three islands are presented and briefly discussed. These showed that the phosphates from the island of Juan-de-Nova contain very little nitrogen, and that almost all of the phosphoric acid present is insoluble in water. The phosphate from Europa showed the composition and characteristics of a typical unchanged guano. The agricultural value of the phosphates of these islands is considered to be open to question.

Chemical composition of the phosphorite of the island of Juan-de-Nova (Madagascar), J. ORCEL (*Bul. Econ. Madagascar*, 18 (1921), III, No. 31, pp. 167-169).—Chemical studies of samples of the phosphorites of the island of Madagascar are presented and briefly discussed. These show a content of tricalcium phosphate of about 73 per cent and a free calcium oxid content of 8.45 per cent.

Acid phosphate production by the Lipman process.—I, Effect of moisture content of sulphur-floats-soil mixtures on sulphur activities, J. S. JOFFE (*Soil Sci.*, 14 (1922), No. 6, pp. 479-483).—Studies conducted at the New Jersey Experiment Stations on the effect of moisture content of sulphur-floats-soil mixtures on sulphur oxidation activities are briefly reported.

These indicate that for ideal sulphur-oxidizing conditions the cultures should be started with a moisture content of 50 per cent saturation. After the reaction reaches a pII value of 2.8 the moisture content should be gradually raised to a 60 per cent saturation.

Experiments with Rhenania phosphate, E. HASELBOFF and O. LIEHR (*Landw. Vers. Sta.*, 100 (1922), No. 1-2, pp. 21-30).—Laboratory and field experiments with barley, rye, oats, and buckwheat to determine the fertilizing value of the phosphoric acid of Rhenania phosphate are reported.

No marked difference was observed in the results obtained with Rhenania phosphate and Thomas meal. Since none of the soils used had an acid reaction, it is concluded that the favorable action of the Rhenania phosphate can not be attributed to soil reaction.

Some recent views on the liming of soils, H. WENHOLZ (*Agr. Gaz. N. S. Wales*, 34 (1923), No. 1, pp. 7-13).—A summary is given of recent findings as to the influence of lime on soils, particular reference being made to experiments conducted in New Zealand.

With reference to the apparently unprofitable use of lime in Australia, it is concluded that the laboratory determination of soil acidity, lime content, or lime requirement under Australian conditions must be regarded as purely academic, and that the advice given on the need for liming based on such determinations is largely empirical. It is further concluded that the present position calls for caution on the part of the agricultural chemist in the use of indiscriminate theories and recommendations concerning the application of lime until more accurate data from field experiments, which, incidentally, will consider the cost of liming, are available.

Use of agricultural lime in Georgia, L. V. DAVIS (*Ga. Agr. Col. Bul. 271* (1922), pp. 20, figs. 5).—Practical information on the use of lime on Georgia soils is presented in this bulletin, which is based on the results of experiments conducted by the Georgia State College of Agriculture. It is stated that the majority of the soils need lime. Dolomite limestone has been found to equal ordinary limestone in benefiting these soils, but gypsum is considered uneconomical. It is stated that lime should be applied after plowing and before harrowing. The experiments showed that a net profit was obtained from applying lime to soils in which corn, cotton, oats, and pea-vine hay were grown in a rotation.

Sodium fertilization experiments, A. VOLKART and B. SCHMITZ (*Landw. Jahrb. Schweiz, 36* (1922), No. 1, pp. 103-117).—Experiments to compare the influence of straight potash fertilization by the use of potassium sulphate with that of mixed potassium and sodium fertilization by the use of kainit on the total yield, dry matter, and sugar contents of sugar beets are reported.

The results indicated that potassium has the greater influence on the composition of beets, while the sodium influences the total yield and dry matter. The sodium in most cases had an unfavorable influence on sugar content. Since the cost per unit of potassium is about the same in the two salts, it is considered more profitable to use the high grade potash salt as a potassic fertilizer for beets, potatoes, and other crops sensitive to sodium chlorid.

The sulphur content of rain water, L. W. EDMAN (*Soil Sci, 14* (1922), No. 5, pp. 363-367).—The results of analyses of samples of rain and snow taken for a period of one year at the agronomy farm of the Iowa Experiment Station to study the addition of sulphur to the soil in precipitation under actual farm conditions are reported.

The data indicate that with a normal precipitation the total amount of sulphur brought to an acre of soil was 14.89 lbs. With but few exceptions, the amounts of sulphur were fairly constant for each month, and no evidence was obtained that the sulphur content depends directly upon the amount of precipitation. It is believed that about 15 lbs. of sulphur per acre per annum will represent a generally correct figure for rural communities.

The one conclusion drawn from this work is that under actual farm conditions the quantity of sulphur added to the soil per annum in the rain water is not sufficient to overbalance the loss by drainage and cropping.

Carbon-dioxid fertilization, F. RIEDEL (*Tech Landw, 3* (1922), No. 4, pp. 87-89, figs. 4).—The results of several different experiments on the application of carbon-dioxid gas to soils growing different crops are briefly presented and discussed. These were in general favorable to the use of carbon dioxid for the purpose, and it is especially noted that carbon dioxid fertilization was much more effective than heavy treatments of the soil with stable manure and artificial fertilizers. When a soil was gassed and fertilized it was even more productive. It is concluded that treatment of a soil with carbon dioxid causes a better utilization of soil fertility constituents by crops.

Commercial fertilizers, R. H. ROBINSON (*Oregon Sta. Circ. 31* (1922), pp. 16).—This bulletin contains general information regarding the selection, purchase, and use of commercial fertilizers in Oregon, briefly outlines the more important provisions of the Oregon fertilizer control law, and presents the results of actual analyses together with the guaranteed analyses of 57 samples of fertilizers and fertilizer materials offered for sale in the State during 1922. Brief reference is also made to the State lime law, and a table is given showing the different brands of gypsum and limestone sold in the State during 1922.

AGRICULTURAL BOTANY.

[Carnegie Institution of Washington, report of] department of botanical research, D. T. MacDOUGAL ET AL. (*Carnegie Inst. Wash. Yearbook 20 (1921), pp. 43-75, fig. 1*).—The investigations carried on have been confined to the main fields of research to which attention has been devoted for several years.

Growth in trees, D. T. MacDougal.—On the basis of information obtained through the use of the dendrograph in its perfected form (E. S. R., 46, p. 24), a considerable number of generalizations are detailed herein.

A new high-temperature record for growth, D. T. MacDougal and E. B. Working.—It has been found that growth in *Opuntia* may begin at 9° C. (48.2° F.) and extend to 58° C. (136.4° F.), the latter point being higher than any previously recorded for the growth of *Opuntia* or for higher plants in general. Capacity for endurance of high temperatures would suggest the presence of low proportions of salts, giving decreased coagulation effects.

Physical and chemical factors in the growth of asparagus, E. B. Working.—As a survey preliminary to a study of the chemical factors of active growth in plants, the hydration capacities of asparagus (both seedlings and shoots) were tested in a large variety of solutions by means of the auxograph. The commercial asparagus fields of the San Joaquin Valley and of the Sacramento Islands were given considerable study.

Root growth in relation to a deficiency of oxygen or an excess of carbon dioxide in the soil, W. A. Cannon.—Results are presented in formal detail as obtained from both recent and former studies on the relation of root growth to the aeration conditions in the soil.

The action of vitamins, amino compounds, and salts on hydration, D. T. MacDougal.—The supposition that the salts of the common metals which enter into nutritive solutions, as potassium, magnesium, sodium, and calcium, may find their chief importance in restricting, limiting, or defining hydration has been tested, and it appears that the hydroxids of the strong metallic bases limit the hydration of agar according to their position in the electromotive series. In testing the effects of salts of the common metals on swelling of the biocolloidal components, it was found that as chlorids, sodium, and potassium at 0.001 M caused greater hydration of agar than water, the swelling being greater in the potassium. At 0.0001 M, sodium, potassium, magnesium, and calcium chlorids caused greater swelling than in water, the maximum swelling being in sodium, the next in potassium, and the least in calcium.

The action of bases and salts on biocolloids and cell masses, D. T. MacDougal.—The supposition that the common metals which enter into nutrient solutions might find their chief importance in restricting, limiting, or defining hydration of the cell colloids led to a series of tests showing that the strong metallic bases when used at concentrations of 0.01 N do limit or restrict the hydration of agar according to their place in the electromotive series. The least swelling took place under the action of the strongest base, with rubidium unplaced.

Effects of age and of the inclusion of salts on the heterotropic action of colloidal bodies of cytological interest, D. T. MacDougal.—Auxographic measurements of the swelling of sections of dried plates of agar and of gelatin previously described show that the relative enlargement of a colloidal body in its different axes will be determined largely by the unequal stresses which may be set up, as for example, when liquid agar or gelatin is poured on glass and dried without shrinking in area. Tests of sections of plates of pure agar freshly made and a year old have been made, and the results are briefly detailed.

The significance of the data presented lies in the fact that living matter and the structures in the cell, to which so much importance in heredity and physiology is attributed, are bodies in a similar colloidal state. Their changes in form, increase or decrease, division, etc., are inevitably affected by the factors described.

Biotocolloids as membranes; a new colloidal cell, D. T. MacDougal.—Investigations by the author, based upon the fundamental mechanism of enlargement of cells and the growth of organs, were concerned chiefly with the increases which the solid mass of the protoplasm undergoes by swelling as influenced by the nutrient salts, acids, hydroxids, amino compounds, and vitamins, and afford information which may be taken to apply chiefly to cells in the earliest stage of their development.

In these experiments it was found that a mixture of agar, gelatin, and soaps and lipins in hydration and swelling afforded many parallels with the behavior of living and dead cell masses. As living matter may be safely taken to be made up chiefly of carbohydrates, albuminous substances, and soaps or combinations of fatty acids with calcium, potassium, or sodium, the experiments have been extended to include a study of the influence of a mixture of these colloids on osmosis under conditions similar to those prevailing in the plant cell.

In carrying out this purpose a new form of artificial cell or osmotic apparatus was devised, which has yielded some results of value in the consideration of the action of the living cell. Among the features of the action of this device are the operations which parallel those of plasmolysis and of adaptive adjustments of the living cell.

Carbohydrate-amino-acid relation in the respiration of leaves, H. A. Spoehr and J. M. McGee.—In order to pursue the investigations on the carbohydrate economy and respiration of chlorophyllous leaves with greater accuracy and economy of time, the experimental procedure here described was so modified as to employ largely electrical methods, the work being still in progress.

The internal factor in photosynthesis, H. A. Spoehr.—Methods for the study of photosynthesis in land plants have been devised which made use of the electrolytic determination of carbon dioxide by means of absorption in solutions of barium hydroxid. A mass of evidence has been accumulated which supports the dictum that an essential rôle in the photosynthetic process must be ascribed to the protoplasmic activity of the colorless components of the chloroplasts.

Anaerobic experiments with argon, W. A. Cannon and E. E. Free.—In previous reports of this department (E. S. R., 46, p. 25), there were described experiments in which helium was used, instead of the more usual nitrogen, as the diluting gas in experiments with the growth of roots and other plant parts under partial anaerobic conditions. It was discovered that nitrogen and helium did not behave exactly alike, the amount of oxygen necessary for growth being somewhat greater in the former case. It was suggested that the explanation of these effects might lie in the greater rapidity of diffusion of oxygen through helium than through nitrogen. Tests in which argon was used as a diluting gas indicate that this gas behaves almost the same as does nitrogen, this fact confirming the diffusional hypothesis within the limits of the tests here noted, as do also more limited tests noted in which hydrogen behaved about the same as did helium.

Some aspects of metabolism in the fungi, B. M. Duggar.—In the present study it is proposed ultimately to include forms which are diverse both in taxonomic relationship and in habitat or in effects. So far the organisms employed have been chiefly those inducing disease in plants or decay in timber, and they include 19 species belonging to the genera *Aspergillus*, *Botrytis*, *Fusarium*, *Gib-*

berella, Glomerella, Helminthosporium, Penicillium, Polyporus, Sclerotinia, and Sphaeropsis. The relation of the source of nitrogen to the growth of the various organisms employed was determined.

Effects of certain sources of carbon and nitrogen on the production of acid by fungi, B. M. Duggar.—After the growth of the organisms in the cultures referred to in the portion of the report above noted, the H-ion concentration of the remaining culture media was examined colorimetrically with a view to the utilization of such data in pointing out at least the direction of metabolism in respect to acidity or alkalinity of the by-products. Though it is early to make any specific assumptions regarding the significance of changes in H-ion concentrations, it is regarded as certain that the relative concentration of nitrogen and carbon sources, partial exhaustion of the media, temperature, and other factors are important in determining the reaction of the medium.

Vitamin notes, H. W. Fenner.—In an attempt to aid in elucidating some of the problems arising in connection with a study of vitamins, a series of experiments was started, using albino rats as subjects, and investigating particularly the vitamin content of some of the commoner food vegetables, as tomatoes, carrots, sweet potatoes, and sprouted seeds of wheat and beans.

Vegetation of a desert valley, F. Shreve.—Work on the vegetation and physical conditions of the Avra Valley and adjacent areas was chiefly directed during the year to a study of the several soils which the area presents in connection with the plant population.

History of growth in a Monterey pine as read from the longitudinal section of the trunk of a full-grown tree, D. T. MacDougal, H. von Schrenk, and F. Shreve.—Studies are recorded on the growth of a tree (*Pinus radiata*) 20 meters (65.6 ft.) in height and about 40 years old. It is seen from the figures that between the heights of 4 and 8 meters this pine tree was growing at the rate of 2 meters per year, and between the heights of 8 and 14 meters at the rate of 1 meter per year. The diameter growth of the last 5 years, like the height growth, was greatly reduced, while the thickest rings of growth were made in the years which also witnessed the greatest growth in height. A serious obstacle to the accurate determination of age by ring count noted in the present case is the alternation of thick and thin rings, or double rings. The nature of the latest of these accessory rings is established with certainty through dendrograph measurements made by MacDougal. This growth occurred in the fall of 1918, following a 3-day rain of 5 in. in mid-September, and has been detected in several trees and a large number of stumps by use of the increment borer.

Carbon-dioxid-supplying power of the air, B. E. Livingston.—The results are given of preliminary experimentation here briefly outlined indicating that, as in the case of the evaporating power of the air, the carbon-dioxid-supplying power depends upon two component conditions, namely, the partial pressure of the gas (corresponding to the vapor pressure deficit for evaporation) and the velocity of air movement over the standard surface.

Comparative rates of water evaporation from different kinds of surfaces, B. E. Livingston.—To increase information on this subject, pans of water were employed with several forms of porous-cup atmometers in a series of observations made at Tucson, Ariz., in the summer of 1921. The results support the conclusions previously reached, and the white porcelain sphere remains the most satisfactory form of atmometer for the careful study of the evaporating power of the air, at least aside from the influence of sunshine. For less detailed and less precise studies, open pans of liquid water and nonspherical porous cups have their adaptations, and the Bates cloth-wick atmometer (which was in-

cluded in the tests here considered) appears to be satisfactory for roughly general comparisons and for the ecological and forestry work for which it was devised. From the tests indicated it appears that, in the absence of direct sunshine, sugar solution evaporated at a rate less than 10 per cent lower than the rate at which water evaporated under the same conditions. This is in accord with physical theory. Another point brought out, however, was that when both pans were exposed to direct sunshine the sugar solution evaporated considerably more rapidly than did water.

Report of the experiment station for plant physiology for 1920 and 1921, HÖSTERMANN (*Ber. Höher. Gärt. Lehranst. Berlin-Dahlem, 1920-1921*, pp. 93-121, fig. 6).—This report includes, under scientific researches, accounts of studies on the testing of recently instituted protective measures against apple mildew and on the overwintering of spores of the causal fungus (*Podosphaera leucotricha*); resistance of strawberry plants to *Mycosphaerella fragariae*; control of cruciferous finger-and-toe (*Plasmodiophora brassicae*); Uspulun as a successful spray for a rot of onion sets; the biology, hosts, and control of nematodes, notably *Heterodera radiculicola*; parthenocarp in pear varieties; carbon dioxid as fertilizer, 1920; charcoal as a carbon source in plant culture, warm and cold water baths in the forcing house; cultures under electric illumination; influence of sunlight and shade on the anatomy of *Prunus cerasus*; and "Azotogen" (legume bacteria) inoculation research.

Agricultural botany, theoretical and practical, J. PERCIVAL (*London: Duckworth & Co., 1921*, 6. ed., rev., pp. XIV+839, figs. 270).—This work, previously noted (*E. S. R.*, 44, p. 194), has been revised throughout.

Biochemistry: A study of the origin, reactions, and equilibria of living matter, B. MOORE (*London: Edward Arnold, 1921*, pp. VII+340, figs. 6).—This book, dealing intensively with certain properties of living matter, is designed not to serve as a general textbook on the subject, but to furnish a point of view and information regarding the origin, reactions, and balances of living matter, and to deal in a fundamental manner with the physiology of living beings.

The feeding power of plants, A. R. DAVIS, D. R. HOAGLAND, and C. B. LIPMAN (*Science*, 57 (1923), No. 1471, pp. 299-301).—A criticism is given of a previous paper by Truog (*E. S. R.*, 48, p. 25).

Germination in its electrical aspect, A. E. BAINES (*London: George Routledge & Sons, Ltd.; New York: E. P. Dutton & Co., 1921*, pp. XXI+185, figs. 138).—This book purports to give a consecutive account of the electro-physiological processes concerned in development from the formation of the pollen grain to the complete structure of the seedling, together with studies in electrophysiology.

The germination of green seed, G. LOPHORE (*Staz. Sper. Agr. Ital.*, 53 (1920), No. 10-11, pp. 414-418).—An account of studies on greening in plant parts, particularly seeds, suggests that the supposedly corresponding Mendelian character may come to have considerable practical importance.

The behavior of [plant] cell membranes toward iron salts, L. ROSENTHALER (*Ber. Deut. Pharm. Gesell.*, 31 (1921), No. 1, pp. 27-30).—Experimental data and theoretical considerations are presented. It is noted that certain plants washed after removal from an iron chlorid solution and exposed to potassium ferrocyanid and dilute sulphuric acid take on coloration in the roots only.

The external [cell] layer of plants, L. ROSENTHALER and F. KOLLE (*Ber. Deut. Pharm. Gesell.*, 31 (1921), No. 9, pp. 446-453).—Concluding from the above work that a fundamental difference probably exists between the outer cell

layer of aerial and that of subterranean parts of plants, the authors attempted to demonstrate such a difference. They conclude from the data as briefly indicated that capability for becoming wet is a condition to the uptake of liquid and contained solute. The cuticle of the roots examined is pervious in this sense.

Salt effects in bacterial growth.—III, Salt effects in relation to the lag period and velocity of growth, J. M. SHERMAN, G. E. HOLM, and W. R. ALBUS (*Jour. Bact.*, 7 (1922), No. 6, pp. 583-588, figs. 3).—In the present section of this work (E. S. R., 48, p. 432), media adjusted to a reaction of pH 5.4 were used.

It is claimed on the basis of the data as tabulated that the accelerating effect of certain salts upon the growth of *Bacterium coli* is due primarily to an increase in the velocity of growth of the organism during the period of maximum multiplication. The same salts usually also increase the accelerating effect by decreasing the duration of the preliminary latent period.

Physiology of stomata of *Rumex patientia*, J. D. SAYRE (*Science*, 57 (1923), No. 1468, pp. 205, 206).—A summary is given of observations made on the behavior of the stomata of *R. patientia*.

It was found that the stomata closed completely at night, checking water loss from the intercellular spaces of the leaf. When open, the stomata modified the rate of water loss in proportion to changes in their perimeters and not to changes in their areas. Light is the most important environmental factor of stomatal action, while acidity and the amount of water in the guard cells are two internal factors concerned in stomatal movements. The guard cells are said to contain green plastids which are structurally, physiologically, and genetically different from the chloroplasts of the mesophyll. The starch-sugar change in the guard cells is considered an equilibrium reaction, and the point of equilibrium is shifted by changes in acidity. The series of changes which result in the opening of the stomata is said to be as follows:

In the morning light changes the acidity of the guard cells, and this change in acidity makes conditions more favorable for the hydrolytic action of diastase. The diastase in the guard cells changes the starch to sugar, and the formation of sugar results in an increase in the osmotic pressure of the guard cells. Water enters the guard cells from the epidermal cells, which do not change in pressure, and causes them to swell. The swelling of the guard cells causes them to open because the thickened cell wall around the pore stretches less than the thinner parts of the cell wall.

Studies on pollen, III, F. M. ANDREWS (*Ind. Acad. Sci. Proc.*, 1920, pp. 155, 156).—Since the appearance of the author's preceding contribution on this subject (E. S. R., 43, p. 328), the number of plants whose pollen has been studied has been increased from 435 to 540. In case of each the author has used cane sugar solutions of 1, 5, 10, 15, 20, 30, 40, 50, and 60 per cent strength. Some details are given. Only one plant showed a branching pollen tube.

The effect of centrifugal force on plants, F. M. ANDREWS (*Ind. Acad. Sci. Proc.*, 1920, pp. 143-145).—Experiments with centrifugal force applied to plants during early growth (E. S. R., 43, p. 327) show that noticeable differences may develop if the intensity is notably high.

The effect of aeration on plants, F. M. ANDREWS (*Ind. Acad. Sci. Proc.*, 1920, pp. 147, 148).—In experiments here reported *Avena sativa* showed considerable increase of root stature and dry matter with aeration. A like increase with an advance in earliness of flowering due to aeration was noted in the case of white mustard, peas, buckwheat, and sunflower. Confirmation and extension of these results were obtained by E. G. James, working with lettuce.

Falling foliage, M. T. COOK (*Phytopathology*, 11 (1921), No. 8, pp. 337-339).—A brief description is given of the effect of low temperature, sun scald and drought, spray injuries, and weak trees from any cause, as shown by the falling of the foliage.

Do plants exhibit senescence? J. H. PRIESTLEY (*Jour. Bath and West and South. Counties Soc.*, 5. ser., 16 (1921-22), pp. 46-56).—Influenced by the work of Benedict (E. S. R., 34, p. 222), the author has approached from a somewhat different standpoint the question of senescence in plants, with results indicated in some detail and summed up as somewhat indecisive but suggestive.

The scientific fundamentals of plant breeding, E. BAUR (*Die Wissenschaftlichen Grundlagen der Pflanzenzüchtung*. Berlin: Borntraeger Bros., 1921, 1.-2. ed., pp. VIII+115, pls. 6, figs. [9]).—The three sections of this handbook (for farmers, gardeners, and foresters) deal with variation in plants, its causes and laws; the biology of reproduction; and general principles of breeding.

Mutants and hybrids, L. BLARINGHIM (*Ann. Sci. Nat. Bot.*, 10. ser., 3 (1921), No. 5-6, pp. I+XXXI).—This is chiefly a critical and bibliographical examination of evidences bearing upon the characters, nature, and relations of mutants and hybrids.

A note on the probability of an interrelation between the length of the stigma and that of the fiber in some forms of the genus *Gossypium*, R. PRASAD (*Agr. Research Inst., Pusa, Bul.* 137 (1922), pp. 7, pls. 2).—It appears probable, from the results of the work here described, that a dependable interrelation exists between the length of the fiber and that of the stigma in cotton. The length of the fiber is held here to be a dominant character.

Rubber content of North American plants, H. M. HALL and F. L. LONG (*Carnegie Inst. Wash. Pub.* 313 (1921), pp. 65, pls. 3).—A somewhat full account is given herein of preliminary investigations bearing on American rubber resources, parts or phases of this or related work having been previously noted (E. S. R., 42, p. 143; 45, p. 336; 46, p. 42).

The species examined were mostly latex plants, especially species of *Asclepias* and *Apocynum*, the present work being a continuation of earlier studies on native shrubs. Of about 225 North American species examined, about 6 shrubs and 16 laticiferous herbs are considered worthy of further attention.

Though the researches of earlier workers in these genera showed but little rubber, later examinations of other species and ecologic and genetic forms of the same species showed much larger percentages. The acetone-benzene method of analysis was employed. The dry-weight percentages reported are, therefore, for rubber, practically free from resin or other impurities.

The species reported as of special interest are all perennials, some growing on land not at present utilized, springing rapidly from seed and root, and supposedly capable of giving several crops per year, which could be handled almost entirely by machinery. Percentages are often high in association with vigor of growth, and in some cases show increase with age. The amount of rubber varies apparently with species, races, strains, and varied or changing ecologic conditions. Usually leaves exceed stems or roots in yield. An exception is noted in *Asclepias subulata*, the stems of which contain from 2 to 6.4 per cent.

A marked variability in the wild plants, and the number of species involved, indicate that strains with a higher rubber content than any thus far discovered could be developed by breeding and then perpetuated either by using pedigreed seed or by vegetative reproduction.

FIELD CROPS.

Experimental errors of field trials under Mauritius conditions, M. KOENIG (*Mauritius Dept. Agr., Sci. Ser. Bul. 7 (1922), English ed., pp. 12, pls. 5*).—The errors incident to the row method of experimentation were studied with sugar cane, sweet potatoes, and cassava.

Consideration of the data recorded indicated the row plot to be satisfactory for variety trials, but liable to errors of similar magnitude as the rectangular plot method. The probable error of single row plots, 100 to 150 ft. long, varied somewhat with the crop, averaging ± 7 per cent for sugar cane, ± 8 per cent for sweet potatoes, and ± 3 per cent for cassava. Four or 5 replications are considered necessary to obtain an accuracy of ± 3 to ± 4 per cent. Greater accuracy may be obtained from a number of rows 100 to 150 ft. long in different parts of the field than by increasing the row length. The growth of a homogeneous crop on a field before conducting experiments is advised as a test for homogeneity. The errors common to the row method should be considered before placing any significance on observed differences between varieties compared thereby.

Bibliography of standardization of field experiments (*Jour. Amer. Soc. Agron., 15 (1923), No. 1, pp. 33-40*).—One hundred and fifty-five titles are listed.

[**Report of field crops work in the Philippine Islands**], A. HERNANDEZ (*Philippine Agr. Rev., 15 (1922), No. 4, pp. 314-320, 325-329, 332-334, 335, 336, 337-339*).—Experiments conducted at the several stations in 1921 included breeding work and varietal, fertilizer, and cultural tests with rice; breeding work and varietal and fertilizer trials with sugar cane; propagation and seed-bed studies and varietal, selection, curing, and shade-crop tests with tobacco; and various tests with miscellaneous field crops.

Rice stored in baskets lost 44.5 per cent in germination, in cans 63.7, and in gunny sacks 55 per cent. Where water was kept 15 cm (5.9 in.) deep, with a gradual increase as the plants grew taller, only a few weeds, largely *Cyperus* spp. and *Ipomoea reptans*, developed. With water from 0 to 5 cm. in depth numerous species appeared, and four weedings were required.

Tobacco seed in a shaded seed bed germinated earlier and better than that seeded in an open seed bed. One part of formalin to 50 parts of water used as a drench in the seed bed checked fungus and weeds. Neither corn nor cassava made desirable shade crops for the production of wrapper. Leaves wilted in the sun became spotted, lifeless, and brittle after 26 days in the curing shed, and had no uniformity of color, while those placed in the curing shed just after priming were more or less uniform in color and cure, and were flexible and without spots.

The starchy type of Cebu corn yielded more grain than the flinty type per unit area, and had more large kernels. Fifteen per cent of the flinty kernels were destroyed by weevils, 31 per cent of the intermediate type, and 54 per cent of the starchy type.

[**Report of field crops work in Rhodesia, 1921-22**], H. G. MUNDY (*Rhodesia Agr. Jour., 19 (1922), Nos. 5, pp. 536-547, 583-587, pls. 2; 6, pp. 656-663, 694-701, pls. 4*).—The continuation of work with field crops at Salisbury, Gwebi (E. S. R., 47, p. 32), and Bulawayo Experiment Stations is reported as heretofore.

[**Experiments with barley and oats**], I. FORSBERG (*Landtmannen, 6 (1923), No. 4, pp. 53-55*).—The results of experiments to ascertain the relative yielding capacity of barley and oats grown alone or in mixtures are reported in tables and discussed. The work was carried on each year from 1914 to 1922, inclusive, at Alnarp, and in nine years, from 1911 to 1922, inclusive, at Barsebäck.

At Alnarp for the entire period of nine years barley produced 15 per cent more grain by weight than was produced by oats, while at Barsebäck the corresponding difference was only 6 per cent. It is pointed out that barley outyielded oats to the greatest extent during years of low rainfall and sunny and warm summer weather. During the seasons of heavy rainfall with cloudy and cool summer weather oats produced the larger yields of grain. On a hull-free basis, regarding the hull of barley as constituting 11 per cent and that of oats as constituting 25 per cent of the kernel, barley outyielded oats to an even greater extent than when the comparison was made on the basis of the ordinary grain. The average yields of straw were practically the same for the two crops.

When the crops were grown mixed the yields of grain and straw were about an average of the results secured when each crop was grown alone. Two seed mixtures were used, the one consisting of equal parts and the other of two parts of barley to one part of oats. The product of the mixture of equal parts was found to contain about 60 per cent of barley and 40 per cent of oats, and that of the two to one mixture about 75 per cent of barley and 25 per cent of oats. It is concluded that barley is the more reliable crop in the regions the experiments were conducted.

[Experiments with spring wheat and barley], L. FORSBERG (*Landtmannen*, 6 (1923), No. 5, pp. 65-67).—Experiments to determine the relative yielding capacity of spring wheat and barley were conducted at Alnarp from 1914 to 1922, inclusive, and at Hviderup from 1915 to 1922, inclusive, with the exception of 1917. Two varieties of wheat, Kolben and Extra-Kolben, and two varieties of barley, Princess and Gull, were compared.

In the experiments at Hviderup, Extra-Kolben wheat outyielded Kolben, the parent variety, in grain production by an average of 9 per cent, while the straw yield of the two varieties stood about equal. The two varieties of barley gave equal yields of grain, but Princess gave an average yield of straw about 20 per cent greater than that of Gull. The average results for seven years show that the varieties of barley, as compared with Extra-Kolben and Kolben wheat, yielded 23 and 32 per cent more grain, respectively, and that the wheat varieties, as compared with Princess and Gull barley, yielded on the average 16 and 51 per cent more straw, respectively.

The results obtained on the experiment field at Alnarp, while not quite the same, bore out the same general conclusions as to the yielding capacity of the two varieties of wheat as well as to the comparative grain- and straw-producing capacity of the wheat and barley varieties. A discussion of the cost of production of spring wheat and barley and of the values of grain and straw produced points out that spring wheat gave the more profitable returns by about \$2.70 per acre.

The grasses of the Concordia region, Entre Ríos, L. R. PARODI (*Rev. Facult. Agron. y Vet. Buenos Aires*, 4 (1922), No. 1, pp. 24-102, figs. 5).—An enumeration of the species of Gramineae found in the vicinity of Concordia, Entre Ríos, Argentina, with descriptive keys.

The pollination and fertilization of some pasture legumes with a view to their improvement, C. O. JØRGENSEN (*K. Vet. og Landbohøjsk. [Copenhagen]*, *Aarskr.* 1921, pp. 218-244, figs. 2).—Pollination experiments showed *Medicago lupulina* and *Anthyllis vulneraria* to be self-fertile. *M. sativa* is self-fertile, but the flowers must be tripped either automatically or by insects. *Lotus tenuifolius* produced considerable seed after self-fertilization. *Trifolium pratense*, *T. repens*, *T. hybridum*, *L. corniculatus*, and *L. uliginosus* are self-sterile, depending on insects for pollination. Hybridization was not accomplished between *T. pratense*, *T. repens*, and *T. hybridum*. Bumblebees can pollinate all

the above species and are the chief pollinators of *T. pratense*. The honeybee (*Apis mellifera*) can pollinate *T. repens* and *T. hybridum*, and while it can not reach the nectar in *T. pratense*, it is an important pollination factor.

With encaged honeybees 26 per cent of the flowers on 100 clover heads bore seed, whereas 40 heads under natural conditions had 64 per cent of flowers with seed. In *M. sativa* the honeybee obtains nectar without tripping the flower. However, 58 trippings apparently caused by honeybees were observed between June 15 and 20, 1917. Solitary bees, such as Megachile, are held of high importance in pollination, especially of *M. sativa*.

Inoculation in the growing of legumes, P. W. ALLEN (*Washington Col. Sta. Pop. Bul.* 122 (1923), pp. 16, figs. 6).—A practical discussion of the merits and methods of legume inoculation, with the experiences of farmers with cultures sent out by the station. Since 1916 cultures have been supplied for the inoculation of 40,163.5 acres, principally of alfalfa, beans, clover, peas, sweet clover, and vetch.

[**Experiments with Grimm and Cossack alfalfa in Sweden**], H. WITTE (*Sveriges Utsädesför. Tidskr.*, 32 (1922), No. 5, pp. 267-279, fig. 1).—The results are reported of comparative tests of a number of European alfalfa strains with American Grimm and Cossack alfalfa, conducted from 1920 to 1922, inclusive, at Svalöf and at several other points in Sweden. The European strains, which were from Hungary, Italy, France, and Sweden, the Swedish strains including a Svalöf hybrid of blue-flowered and yellow-flowered alfalfa, were compared with Grimm and Cossack alfalfa from seed produced in Minnesota and South Dakota, respectively.

The Grimm seed secured appeared to be of two different strains, as indicated by a consistent difference in yielding capacity. The American varieties were fully equal in production to the best European strains in the test, and it is concluded that both varieties are of value for Sweden.

A new variety of barley with striking characteristics, K. S. HOR (*Science*, 55 (1922), No. 1423, p. 378).—A six-row barley, discovered by J. M. Mack, of Fall Brook, Calif., and termed "Mack Branched," is characterized by an increased number of nodes with an irregular shortening of internodes, capacity to branch and to produce roots at any node, and a possibility of vegetative propagation. Although the new form itself is apparently without agricultural value, the branching and cold resistant characters may be used to advantage by hybridization with some of the commoner types of cultivated barley.

Many-noded dwarf barley, H. V. HARLAN and M. N. POPE (*Jour. Heredity*, 13 (1922), No. 6, pp. 269-273, figs. 4).—A barley plant with many extremely short internodes and an abundance of fine leaves was found in Mesa, an agricultural variety of *Hordeum distichon nudum*. The plant was very short with slow development, and many of the 17 culms were branched near the base. The other peculiarities of the plant and its progeny are described and illustrated. No dwarf characteristics were found in the F_1 of hybrids between Baku, Manchuria, Utah Winter, and Nepal, and the dwarf barley, but in the F_2 generation normal and dwarf forms segregated in a ratio of about 3:1, indicating that the dwarf character is a Mendelian recessive. Few dwarf plants (E. S. R., 42, p. 133; 47, p. 825) have been reported in barley.

Fertilizer experiments with cotton, J. T. WILLIAMSON and M. J. FUNCHES (*Alabama Sta. Bul.* 219 (1923), pp. 23, fig. 1).—Fertilizer practice for cotton on the distinct soil divisions of Alabama is recommended on the basis of 226 local cooperative fertilizer tests (E. S. R., 31, p. 40; 41, p. 335; 43, p. 233) with the crop. The least returns from commercial fertilizers were obtained on Black Belt soils.

Sodium nitrate returned better profits than cottonseed meal in all sections of Alabama and is recommended in each of the formulas. Early applications were found to pay better than late applications. The returns from all fertilizers, except sodium nitrate, were reduced after the advent of the boll weevil.

The gray soils over yellow subsoils of southeast Alabama require considerable potash and relatively little phosphoric acid. All red soils, gray soils with red subsoils, and, in the southwest part of the Lower Coastal Plain, gray soils with yellow subsoils need less potash than the gray soils of southeast Alabama. The response to phosphoric acid on these soils is relatively low. The fertilizer needs of the Upper Coastal Plain are very similar to those of southwest Alabama. In this division sodium nitrate produced especially good results.

Soils of the Piedmont and Appalachian Plateaus responded well to sodium nitrate and acid phosphate, but their potash needs were comparatively low. The gray or yellow chert-free soils with heavy yellow subsoils of the Limestone Valley regions need much potash and give a good response to acid phosphate and sodium nitrate. Sodium nitrate produced greater returns on the red lands of the Limestone Valleys than on any other soils of Alabama. A strong need for phosphoric acid and a low potash requirement is indicated. Acid phosphate was used to its best advantage on the Highland Rim, and a moderate amount of potash returned good profits in this area.

The culture of Egyptian cotton in Arizona, F. VUILLET (*La Culture du Coton Égyptien dans l'Arizona*. [Dakar: Gouv. Gén. Afrique Occident. Franç.] Paris: Émile Larosc, 1922, pp. 88, pls. 8).—Observations on the growing of Egyptian cotton in Arizona are given in detail, including a historical account, notes on the geography of Arizona and on the Salt River Valley and project, the characteristics of Pima cotton, and factors involved in the production of the fiber.

Studies of manila hemp, M. HALAMA (*Faserforschung*, 1 (1921), No. 3, pp. 169-190, pls. 2, figs. 17).—Botanical notes are given on the fibers of the genus *Musa*; the development histories of the fibers of *M. textilis*, *M. sapientum*, and *M. cavendishii* are outlined; and a discussion is presented concerning the origin of the commercial fibers, their cell structure, and their differentiation in fabrics.

Value of the hemp plant for investigating sex inheritance, W. S. MALLOCH (*Jour. Heredity*, 13 (1922), No. 6, pp. 277-283, figs. 7).—This contribution from the University of Illinois enumerates the merits and demerits of the genus *Cannabis* for the purpose indicated.

The improvement of peanut culture (*Études et Avant-Projets sur l'Amélioration de la Culture de l'Arachide*. [Dakar: Gouv. Gén. Afrique Occident. Franç.] Paris: Émile Larosc, 1922, pp. 112, pls. 6, figs. 10).—This brochure includes Peanut Culture in the United States, by P. Ammann and G. Denis (pp. 7-77); The Improvement of Peanut Culture in Senegal, by Y. Henry (pp. 79-87); and The Prospectus for a Peanut Experiment Station in Senegal, by G. Denis (pp. 89-111).

Possibilities and requirements of potato culture on peaty soil, H. WITTE (*Svenska Mosskulturför. Tidskr.* 37 (1923), No. 1, pp. 4-36, figs. 11).—This article, representing a paper presented at the meeting of the Swedish Moor Culture Association held in November, 1922, discusses briefly the history and present status of potato culture in Sweden, and reviews in the light of their bearing on the subject considered the results of a number of experiments conducted at different times in various localities.

It is shown that moor soils as compared with sandy and clay soils produce profitable yields of potatoes, that frosts early in the fall affect the returns,

and that tubers grown on moor soil may have good keeping qualities. It is pointed out further that liming these soils may not produce an increase in yield, while the application of sand or clay on moor soils and of sand on peaty or boggy soils tends to produce better crops, and that for successful potato culture moor soils should be drained at least to a depth of 40 in. Attention is called also to results of experiments on moor and bog soils indicating the value of nitrogenous fertilizers, especially sodium nitrate and barnyard manure, for potatoes on such soils, although they may be rich in nitrogen. Likewise it is shown that planting potatoes on these types of soil about May 8, when the soil temperature at a depth of about 8 in. ranged from 6.5° to 7° C. (43.7 to 44.6° F.) gave the best yields, and that medium sized potatoes were preferable for seed.

The results of variety tests are presented in tables giving yields of tubers and starch, and indicating that in general the early varieties gave the best returns. Results are reviewed also to show that seed tubers produced on moor or peaty soils, as compared with those grown on sandy soil, are likely to give the better yields when planted on sandy soil, while on moor soils the difference in yielding capacity does not seem to be so significant.

The general conclusion is drawn that potato culture on peaty soils and especially on moor soils, if not in locations subject to frost injury, has great possibilities and promises high or at least satisfactory yields of potatoes for feeding purposes, provided the soil is adequately drained, prepared, and fertilized, seed of good quality and of suitable early varieties is planted at the proper time, and the necessary cultivation is given.

A study of proso. S. LEWICKI (*Pam. Państw. Inst. Nauk. Gosp. Wiejsk. Puław*) (*Mém. Inst. Natl. Polonais Écon. Rurale Puławy*), 1 (1921), A, No. 2, pp. 193-200, fig. 1.—The observations cited indicate that in Poland, proso (*Panicum miliaceum*) is ordinarily self-fertilized. The viscosity of the pollen is said to be such that any cross-fertilization found is due to insects, and not to the wind.

Sugar cane experiments in the Leeward Islands, 1919-20 and 1920-21. A. E. COLLENS ET AL. (*West Indies Imp. Dept. Agr., Leeward Isl. Sugar-Cane Expts., 1919-20, pts. 1-2, pp. 57; 1920-21, pp. 43*).—Reports are made on experiments with varieties of sugar cane in Antigua, St. Kitts-Nevis, and Montserrat similar to and continuing earlier work (E. S. R., 45, p. 434).

The leading plant canes in Antigua were B. 6308, with 23.1 tons of cane and 5,100 lbs. of sugar per acre in 1919-20, and B. H. 10(12), with 18.1 tons of cane and 4,070 lbs. of sucrose in 1920-21. Sealy Seedling plant cane, with 6,410 lbs. of sucrose, led the 7 varieties grown during 20 years. B. 3922, with 14.4 tons of cane and 3,350 lbs. of sucrose, led ratoons in 1919-20, and B. H. 10(12), with 15.8 tons of cane and 3,160 lbs. of sucrose, in 1920-21. Sealy seedling led the ratoons tested during 19 years, with an average of 3,430 lbs. of sucrose.

In both seasons B. H. 10(12) averaged first among the plant and ratoon canes on St. Kitts. D. 216 and B. 6308 in 1919-20, and D. 6388 and B. 6450 in 1920-21, led plant canes on Nevis. B. H. 10(12) in 1919-20, and B. 254, A. 2, and Sealy Seedling in 1920-21, produced the most sucrose of the plant canes tried on Montserrat.

The results of fertilizer experiments at St. Kitts showed profitable returns from the continuous application of pen manure and nitrogen as ammonium sulphate. In the absence of pen manure the most profitable results were from the use of a complete fertilizer containing 40 lbs. of nitrogen either as ammonium sulphate or sodium nitrate. An increase in the amount of nitrogen has not produced a corresponding increase in the yield of cane per acre.

The species and varieties of wheat, and their determination, S. LEWICKI (*Pam. Państw. Inst. Nauk. Gosp. Wiejsk. Pulawach (Mém. Inst. Natl. Polonais Écon. Rurale Pulawy)*), 1 (1921), A, No. 2, pp. 95-140, figs. 3).—The author describes and classifies 238 varieties of wheat grouped under the species *Triticum vulgare*, *T. turgidum*, *T. durum*, *T. spelta*, *T. monococcum*, *T. dicoccum*, *T. polonicum*, and *T. compactum*. A discussion in French of the characters serving to differentiate species and varieties is appended.

The common white wheats, J. A. CLARK, J. H. MARTIN, and C. E. LEIGHTY (*U. S. Dept. Agr., Farmers' Bul. 1301* (1922), pp. 42, figs. 20).—Of the 52 varieties of common white wheat grown commercially in the United States and here described 35 are spring wheats and 17 are winter. Washington, California, Oregon, Idaho, and New York lead in their production, which amounts to over 3,000,000 acres annually, or about 5.4 per cent of the total wheat acreage in the United States. Many of the characteristics of Pacific Bluestem, Baart, Federation, and Hard Federation, spring varieties of Australian origin, have been indicated in a work noted earlier (*E. S. R.*, 44, p. 39). Goldecoin (Fortyfold) is the most widely grown of the winter varieties of white wheat, White Winter gives the highest yield in the Willamette Valley of Oregon, and Dawson is most productive in most of Michigan, New York, and Pennsylvania.

The soft red winter wheats, C. E. LEIGHTY and J. H. MARTIN (*U. S. Dept. Agr., Farmers' Bul. 1305* (1922), pp. 54, figs. 49).—The areas where the soft red winter class of wheats is grown and to which it is adapted are pointed out, and the varieties embraced are described and illustrated.

Soft red winter wheat comprises about 30 per cent of the total wheat acreage of the United States, more than 20,000,000 acres being grown in 1919. The States leading in production are Missouri, Indiana, Ohio, Illinois, Texas, Kansas, Pennsylvania, and Oklahoma. The most widely grown of 66 distinct varieties of soft red winter wheat are, in the order of importance, Fultz, Fulcaster, Mediterranean, Poole, Red May, Red Wave, and Harvest Queen.

The inheritance of the spring and winter growing habit in crosses between typical spring and typical winter wheats, and the response of wheat plants to artificial light, H. P. COOPER (*Jour. Amer. Soc. Agron.*, 15 (1923), No. 1, pp. 15-25).—The major part of this contribution from Cornell University consists of a study of the inheritance of the spring and winter growing habit, involving Dawson, Kanred, and Fulcaster winter wheats, and Haynes Bluestem (Minnesota No. 169) and Marquis spring wheats.

The fall-seeded spring wheats matured from one to two weeks later in the spring than the true winter wheats. In both direct and reciprocal crosses between true spring and true winter wheats, the short vegetative period was dominant. When Marquis was crossed with each of the three winters, a ratio of about 13 springs to 3 winter forms showed in the F_2 , indicating that apparently a dominant factor for winter and an inhibitor against winter were involved. The F_2 plants of the cross showed a segregation close to that expected. All the crosses with Haynes Bluestem gave a ratio of about 3 spring forms to 1 winter, and the F_2 families agreed with the expected ratio.

The genetic constitution for winter and spring growing habit suggested from the data was for true winters $SSii$, Marquis $ssII$, and Haynes Bluestem $SSII$. If Haynes Bluestem carries a dominant factor for winter and an inhibitor for winter, it is thought possible to cross it with the spring segregate ($ssii$) out of the Marquis cross and get true winter types from two true springs.

Artificial light greatly reduced the time from sowing to heading with early greenhouse plantings, but with seedlings as late as February 18 much less reduction was noted in the length of the vegetative period.

Observations on winter hardiness in 1921-22, Å. ÅKEEMAN (*Sveriges Utsädesför. Tidskr.*, 32 (1922), No. 5, pp. 252-266, fig. 1).—The results here reported and discussed were obtained in observations on the hardiness of a series of wheat varieties and their crosses, made in connection with winter wheat experiments conducted at Svalöf. The relative hardiness of different varieties is shown in tables, and the behavior of individual sorts is described.

A study of the content of sugar and allied substances in the plants pointed out a quite definite correlation between this content and winter hardiness. Swedish Sammetsvete ranked first in hardiness and in sugar content, while Svea and Thule II wheat stood second and third, respectively, in these characters. The standing of the other varieties in the list bore out the same general relationship. The objects to be sought for in wheat breeding as suggested by those and other results are briefly pointed out.

Seed identification, C. FRUWIRTH (*Die Saatenanerkennung. Berlin: Paul Parey, 1922, 2. ed., rev. and enl., pp. 152, figs. 81*).—A revised and enlarged edition of the work noted earlier (E. S. R., 44, p. 143).

[**Investigation of the frequency and relative importance of the more common weed species in Sweden**], P. BOLIN (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 239* (1922) pp. 36, pls. 39; also *K. Landtbr. Akad. Handl. och Tidskr.*, 1922, *Bilaga*, pp. 36, pls. 39).—Tables are given showing the comparative frequency of 38 species of weeds in Sweden as a whole, and as divided into the different sections of eastern and western Southern and Middle Sweden, and Northern Sweden. The behavior and economic importance of each species are discussed. The common and scientific names are given, and the distribution and frequency of the different species are indicated on a series of colored plates, including a geological map of the country.

Quack grass, L. W. KEPHART (*U. S. Dept. Agr., Farmers' Bul. 1307* (1923), pp. 32, figs. 15).—The distribution, history, and characteristics of quack grass or witch grass are reviewed, together with the details of control principles and practices.

Quack grass can rarely be exterminated on large areas, but may be brought under reasonable control, preferably by permitting sod formation which is plowed in midsummer during hot, dry weather. After plowing, the field should be harrowed frequently until winter and planted with a cultivated crop the following year. A smother crop may follow the cultivated crop. On small areas the grass can be eradicated by hand digging, smothering with tar paper, spraying with chemicals, or by other means. Since quack grass makes good hay, pasturage, silage, and lawns, it often can be utilized more economically than it can be destroyed.

HORTICULTURE.

Principles and technique of plant improvement, J. BECKER (*Grundlagen und Technik der gärtnerischen Pflanzenzüchtung. Berlin: Paul Parey, 1922, pp. XVI+400, pls. 17, figs. 149*).—A comprehensive text covering the entire range of plant improvement, namely, propagation, origin of new forms, mechanism of heredity, appliances used in plant breeding, and the aims and purposes of breeding.

The effect of nodule bacteria on the yield and nitrogen content of canning peas, E. B. FRED and O. C. BRYAN (*Soil Sci.*, 14 (1922), No. 6, pp. 413-415).—A study conducted at the Wisconsin Experiment Station in the spring of 1921 on the effect of inoculation on the Horsford canning pea indicated that this treatment has a marked influence on the nitrogen content of all parts of the resulting plant, with little or no effect upon the yield. The experiments

were conducted on two types of Miami silt loam soil, both slightly acid but differing in fertility. Records taken at the time of canning maturity upon plants grown on the more fertile soil with and without inoculation showed that, despite the lesser number of plants on the inoculated plats, there was a substantial increase in nitrogen, amounting to 37.25 lbs. per acre in the plants of the inoculated plat. On the poorer soil, whose total nitrogen percentage was 0.18 as compared with 0.228 for the more fertile area, a well defined difference was observed between the inoculated and the uninoculated plants, the former being taller and of a richer green color. Computations showed a gain of 13.2 lbs. of nitrogen per acre in favor of inoculation. There were no significant gains in respect to yield on either of the two soil types.

Quality in nursery stock, S. W. FLETCHER (*Natl Nurseryman*, 31 (1923), No. 3, pp. 65-70).—A general discussion in which are reviewed investigations in progress or recently completed which have a direct bearing on the improvement of fruit tree stocks.

The relation of orchard practices to fruit bud development, E. J. KRAUS (*Mich. State Hort. Soc. Ann. Rpt.*, 49-50 (1919-20), pp. 47-51).—A discussion of rational orchard management practices as based on the actual needs of the tree, explained in the light of the carbohydrate nitrogen theory.

Fruit bud formation, E. J. KRAUS (*Mich. State Hort. Soc. Ann. Rpt.*, 49-50 (1919-20), pp. 87-92).—The author discusses the close relation between the condition of the tree and its fruiting capacity, and suggests how different conditions may be induced or modified by pruning and fertilizing.

Preliminary smudging experiments, F. GARCIA and A. B. FITE (*New Mexico Sta. Bul.* 134 (1922), pp. 26, figs. 6).—Tests conducted in the spring of 1922 at State College, N. Mex., located at an elevation of 3,838 ft. indicated that orchard heaters are effective in preventing frost injury to early blossoming fruits when the margin of safety lies within a few degrees and high winds do not prevail. In an 0.6-acre orchard of Crother peaches, the temperature was raised from 3 to 5° F. with the aid of 40 large Bolton heaters. With 80 heaters burning a maximum raise of 9° was obtained.

Favorable results reported by county agents at Roswell and Los Lunas are mentioned, and information of a general nature relating to smudging materials, apparatus, costs of operation, etc., is presented. Since records taken at the station over a period of years show that newly opened blossoms and newly set fruit can withstand a temperature of 26° for a brief period, it is pointed out that the injurious effect of comparatively low temperatures may be prevented by the use of heaters.

Fruit setting on the J. H. Hale peach, C. H. CONNORS (*Amer. Soc. Hort. Sci. Proc.*, 19 (1922), pp. 147-151).—A critical study of the flowers and fruits of the J. H. Hale peach conducted by the New Jersey Experiment Stations in the spring of 1922 to determine the cause of the formation of undersized, misshapen, seedless fruits characterized as "buttons" led to the conclusion that these abnormal fruits are due to imperfect pollination. The anthers of J. H. Hale, like those of Belle seedlings examined in 1920, were found to be very pale in color, reduced in size, and attached to unusually short filaments. In appearance the anthers were simply a mass of tissue with no spore forms. The poor character of the pollen was shown by failure to germinate in sugar solutions. In attempting to explain the development of the abnormal fruits, the author believes this condition may possibly be due to an incomplete fertilization, in which the pollen tube, too slow in growth to reach the ovum in time for fusion, nevertheless stimulates vegetative vigor. This hypothesis is predicated on the existence of a slight amount of viable pollen. The author, emphasizing the necessity of interplanting the J. H. Hale peach with fertile

varieties, points out that the general acceptance of self-fertility in the peach will have to be modified.

Influence of position on production of laterals by branches, F. F. HALMA (*Calif. Citrogr.*, 8 (1923), No. 5, pp. 146, 180, figs. 2).—According to the principles of the Caldwell method of training pear trees (*E. S. R.*, 46, p. 736), two comparable sets of long, succulent branches of Eureka lemon were cut back to the mature wood in the spring before growth commenced, and one set was trained to a horizontal position. Data taken at the end of the growing season showed that the 22 horizontal branches, averaging 65 cm. (25.59 in.) in length, possessed an average of 15.4 laterals, 14.5 of which were of the fruiting type. The 22 vertical branches, averaging 64 cm. (25.2 in.) in length, possessed an average of 6.7 laterals, 3.6 of which were of the fruiting type. On the horizontal branches the laterals were quite evenly distributed along the entire length and were fairly equal in length, while on the perpendicular branches a considerable portion of the main stem was entirely devoid of laterals.

Observing that practically all the laterals on the horizontal branches developed from the upper side, the lower buds remaining dormant, certain of the horizontals were bent over so that the young laterals were all on the under side. As a result, the dormant buds soon sent forth shoots which by the end of the season exceeded the original laterals in length. While the total number of laterals on the shifted horizontals was much larger than that on the unshifted there was practically no difference in the total length of growth produced. The author believes that the performance of the horizontal branches may be satisfactorily explained by the previously discussed hypothesis of an inhibitory substance (*E. S. R.*, 44, p. 133).

When is pruning profitable? E. J. KRAUS (*Mich. State Hort. Soc. Ann. Rpt.*, 49-50 (1919-20), pp. 54-62).—The fundamental principles of orchard tree pruning are discussed in relation to the physiology of the tree.

The possible relation of spring temperatures to the keeping quality of the cranberry crop, N. E. STEVENS (*Amer. Cranberry Growers' Assoc. Proc. Ann. Meeting*, 53 (1923), pp. [5-9]).—An apparent correlation between temperature summations for the growing season and keeping quality was observed by the author in a study of factors influencing the keeping quality of cranberries grown at Wareham, Mass. In general, cool springs and hot summers favored the production of sound berries.

Strawberries, C. E. SCHUSTER (*Oregon Sta. Circ.* 32 (1923), pp. 16, figs. 2).—This circular contains information relating to the selections of sites, preparation of soil, fertilization, varieties, planting, culture, irrigation, harvesting and marketing, and insect and disease control. The everbearing group of strawberries is considered separately.

Intensive strawberry culture, L. GRATON (*Whitman, Mass.: Author*, 1922, pp. 91, figs. 11).—A handbook of practical information designed primarily for the small home owner.

Fertilization and management of grapes, H. A. NOYES (*Mich. State Hort. Soc. Ann. Rpt.*, 49-50 (1919-20), pp. 207-210).—Emphasizing the importance of drainage, tillage, and fertilization in the maintaining of yield in the vineyard, the author asserts that proper handling of the soil is more important than original fertility.

On the germination of coconuts, R. B. ESPINO (*Philippine Agr.*, 11 (1923), No. 6, pp. 191-200).—Germination studies with the coconut at the College of Agriculture, Los Baños, P. I., in the summer of 1920, indicated that several commonly accepted notions in regard to coconut propagation are not fundamentally sound. For example, dead-ripe nuts were found to be more satisfactory for seed than immature nuts. Partial or complete removal of the husks,

except in the case of nuts entirely buried in the soil, resulted in a cracking of the shell, with consequent entrance of disease-producing organisms. Nuts placed on their sides in the seed bed germinated more rapidly and in a more normal manner than did those placed on either end. Seedlings in which the plumule had attained a height of from 15 to 30 cm. (6 to 12 in.) proved most satisfactory for transplanting, in that at this stage the reserve food supply was still ample to support the young plant.

Improvement of the lanzon (*Lansium domesticum* Jack), N. B. MENDIOLA (*Philippine Agr.*, 11 (1922), No. 4, pp. 117-123, pl. 1).—Six distinct types of lanzon (*L. domesticum*), distinguished chiefly according to fruit characters, were discovered in a survey of Laguna Province, Luzon. Data presented in tabular form relative to size, flavor, and quality of fruit, date of blossoming and ripening, character of seeds, and yield of fruit showed wide differences among the six types, varying from high to inferior quality. It is believed that hereditary variations in the lanzon are often masked by the uneven spacing of the trees, there being no regularity in manner of planting.

No success was obtained in an attempt to propagate this fruit by cuttings and budding. Failure also resulted in an attempt to utilize santol, a closely related species, as a stock. Grafting, on the other hand, was successful. Search for seedless fruits revealed the fact that symmetry of fruit indicates complete seediness or seedlessness. Partial seed development was, on the other hand, usually indicated by imperfect shape. The entire absence of seed was generally correlated with small size. Computations made with the aid of Yule's formula showed a correlation of $+0.741 \pm 0.014$ between absence of seed and symmetry in a population of 478 fruits. It is not yet determined whether seedlessness is due to parthenocarpy or to hereditary factors.

Some experiments in the storage of lemons, W. J. ALLEN (*Agr. Gaz. N. S. Wales*, 34 (1923), No. 2, p. 127).—In tests conducted at the Yanco Experiment Farm, lemons dusted with slaked lime kept somewhat better than untreated fruits. In a somewhat similar test at the Hawkesbury Agricultural College, in which three protective treatments, namely, (1) vaseline coating, (2) sulphur dusting, and (3) slaked lime dusting, were compared, the liming treatment was slightly the most successful. However, none of the three treatments were significantly better than that of simple wrapping in paper.

A descriptive list of mango varieties in India, P. J. WESTER (*Philippine Bur. Agr. Bul.* 36 (1922), pp. 96, pls. 3, figs. 71).—A large number of Indian mango varieties are illustrated, briefly described, and discussed relative to place of origin, synonymy, and value.

Cultural experiments with exotic trees, BOBEN (*Ztschr. Forst. u. Jagdw.*, 55 (1923), No. 2, pp. 74-90).—This paper presents the results of tests in Germany of a large number of exotic species, including many of American origin.

The effect of aluminum sulphate on rhododendron seedlings, F. V. COVILLIE (*Amer. Hort. Soc. Bul.* 1 (1923), pp. 6, pls. 5).—The very active stimulating effect of aluminum sulphate upon the growth of *Rhododendron catawbiense* was shown in a test in which plants potted in a rich garden soil were treated with the following solutions (1) distilled water, (2) distilled water and magnesium sulphate, and (3) distilled water and aluminum sulphate. The increase in the diameter of the rosettes of leaves were, respectively, 0, 30, and 250 per cent. The aluminum sulphate plants were almost as large as plants grown in an ideal potting mixture of peat and sand.

Death resulted to part of a lot of small rhododendrons growing in porous pots, the soil of which was treated with a concentrated solution, $\frac{1}{4}$ gm. of aluminum

sulphate to 1 cc. of water. The surviving plants later revived and showed the same stimulation of growth as those receiving weaker solutions.

Potted plants which for more than a year had made a sickly growth in rich garden soil were revived in an 11-week period by two mild applications of aluminum sulphate. The leaves of the treated plants assumed a bright, healthy green color, while those on the control lot remained sickly and dull.

In explanation of results, the author believes that the aluminum sulphate acts to replace the lime in the soil with aluminum, the released lime leaching away in the form of calcium sulphate. As a result, the soil reaction is changed from neutrality or alkalinity to acidity, with consequent favorable action on acid-loving plants such as rhododendron. It is suggested that for greenhouse experiments 1 part of aluminum sulphate to 200 parts of soil by bulk may be taken as a standard mixture. Outdoor proportions have not been determined, but it is believed that amounts up to $\frac{1}{2}$ lb. per square yard may be safely applied to fertile soils and repeated if the acid reaction is not attained. In conclusion, the author warns that the use of aluminum sulphate is still in the experimental stage, and as such must be used with extreme caution.

Rock gardens and alpine plants, including water, bog, wall, and moraine gardens. T. W. SANDERS (*London: W. H. & L. Collingridge, [1922], 3. ed., pp. 205, pls. 59, figs. 19*).—Information of a popular nature is presented relative to the selection and preparation of sites, the choice of plant materials, and the care of rock gardens.

FORESTRY.

Research as aid to forest production. J. W. TOUMNEY (*Canad. Forestry Mag., 19 (1923), No. 3, pp. 176, 177, 189-190, figs. 2*).—Emphasizing the urgent need of forestry knowledge based on careful and long-time investigations, the author suggests certain studies, such as those involving ways and means of securing sustained production, which are vitally needed.

Bernhard Eduard Fernow—an appreciation. C. D. HOWE (*Canad. Forestry Mag., 19 (1923), No. 3, pp. 168, 169, fig. 1*).—This tribute to the first forester of the U. S. Department of Agriculture (E. S. R., 48, p. 399) contains information relative to his life activities.

Trees as good citizens. C. L. PACK (*Washington: Amer. Tree Assoc., 1922, pp. 257, pls. 40, figs. 96*).—In this profusely illustrated text information of a general nature is given concerning species of trees, selection for special uses, planting, care, etc.

Thirty important forest trees of Maryland: How to know them ([*Baltimore*]: Md. State Bd. Forestry, 1922, pp. 35, figs. 30).—With the aid of linear illustrations, information of a nontechnical nature is presented as an aid in the identification of 30 important trees of Maryland.

Germination tests with white pine seed. SCHWAPPACH (*Allg. Forst. u. Jagd Ztg. [Frankfort on the Main], 98 (1922), Sept., pp. 202-204*).—Observing white pine to be the most difficult conifer species on which to secure germination counts, the author discusses two methods of testing in practice at three German seed testing stations designated in the text as A, B, and C. At stations A and C the seed was submitted to a freezing temperature for 30 days previous to testing, the test itself being conducted at 77° F. At station B the seed, following immersion in water over night, was grown in paper testers held at a variable temperature, 68° for 18 hours and 86° for 6 hours of each day. In practically every instance the method embracing preliminary freezing, employed at stations A and C, resulted in higher percentages of germination over a given period, usually 60 days. Incidentally it was shown that fresh seed is much

more viable than old seed, e. g., fresh seed tested over a 60-day period beginning with October, 1920, gave 91 per cent germination, the same seed in November, 1921, 38 per cent, and in February, 1922, 23.7 per cent.

In concluding, the author points out that the best method of keeping white pine seed is yet undetermined, but he believes that storage in closely sealed vessels held in a cool, dark situation is probably the most satisfactory practice.

Sustained yield in certain forest localities in Massachusetts, H. O. COOK (*Jour. Forestry*, 21 (1923), No. 1, pp. 48-53).—Massachusetts contains two restricted areas, one in Plymouth County and the other in the northern part of Worcester County, which, despite the lack of systematic plans, maintain sufficient sustained production of white pine to support important woodworking industries. In Plymouth County boxes are manufactured for the cranberry growing and shoe manufacturing industries, and in Worcester County lumber is furnished for toy factories.

Forest fires in California, 1911-1920: An analytical study, S. B. SNOW and E. I. KOROK (*U. S. Dept. Agr., Dept. Circ.* 243 (1923), pp. 11+80, figs. 40).—With a view to determining methods of analyzing data in accordance with recognized statistical practice, thereby revealing certain underlying principles and tendencies which may assist materially in fire control, the authors studied data on 10,499 fires occurring in 12 national forests of California during the period 1911-1920.

It was found that fires grouped according to cause had special characteristics in seasonal distribution, location, manner of occurrence, rate of spread, and difficulty of control. The authors believe that man-caused fires may be greatly reduced by educational propaganda and rigid law enforcement, and emphasize that such reduction is equivalent to increasing the fire fighting forces. The determination of the areas of particular hazard in different forests is recommended as an essential step in efficient use of fire fighting units. Successful protection demands first of all a clear-cut, definite objective, and is attained only when the cost of prevention, suppression, and damage is held at the lowest possible point. The speed of attack was found to be an important factor in reducing fire damage, and to be dependent upon the existence of an adequately manned fire fighting organization. Since occasional years of extreme hazard may result in tremendous damage, it is essential that the organization be developed with a view to coping with serious emergencies. The statistical data upon which the analysis is based are appended in tabular form.

Forest protection, fire prevention, and extinction (*Penn. Dept. Forestry Bul.* 27 (1922), pp. 5+18, figs. 12).—With the assistance of illustrations, concise practical directions are presented for combating forest fires.

The ninety-ninth and hundredth reports of the commissioners of His Majesty's woods, forests, and land revenues, A. GRIFFITH-BOSCAWEN and G. G. L. GOWER ([*Gr. Brit.*] *Commr. Woods, Forests, and Land Rev. Rpts.*, 99 (1921), pp. 62; 100 (1922), pp. 55).—These are administrative reports consisting largely of statistical information covering the periods ended March 31, 1921, and March 31, 1922.

Progress report of the forest administration in the Province of Assam for the year 1921-22, F. TRAFFORD and N. B. DEANE (*Assam Forest Admin. Rpt.*, 1921-22, pp. 15+49).—This is the usual annual report (*E. S. R.*, 46, p. 645), discussing alterations in area, silvicultural operations, financial results, etc.

Minor products of Philippine forests, I-III, edited by W. H. BROWN ([*Philippine*] *Bur. Forestry Bul.* 22, 1920, vol. 1, pp. 1+432, figs. 179; 1921, vols. 2, pp. 1+410, figs. 158; 3, pp. 1+329, figs. 65).—This is a collection of

papers on the products of the Philippine forests other than timber. In Volume 1 are Philippine Mangrove Swamps (pp. 9-125), Philippine Palms and Palm Products (pp. 127-248), and Philippine Bamboos (pp. 249-310), all by W. H. Brown and A. F. Fischer; Philippine Fiber Plants, by W. H. Brown (pp. 311-412); and Philippine Forest Products as Sources of Paper Pulp, by W. H. Brown and A. F. Fischer (pp. 413-425). In Volume 2 are Philippine Resins, Gums, Seed Oils, and Essential Oils, by A. P. West and W. H. Brown (pp. 5-224); and Wild Food Plants of the Philippines (pp. 225-377) and Natural Dyes of the Philippines (pp. 379-406), both by W. H. Brown. In Volume 3 are Ornamental Plants from Philippine Forests (pp. 5-46), Philippine Plants Used as Soap Substitutes or Scouring Materials (pp. 47-59), Official Philippine Medicinal Plants (pp. 61-75), Poisonous Philippine Plants (pp. 77-82), and Miscellaneous Useful Wild Philippine Plants (pp. 83-96), all by W. H. Brown; Philippine Edible Fungi, by O. A. Reinking (pp. 97-147); and Medicinal Uses of Philippine Plants, by L. M. Guerrero (pp. 149-246).

Rubber: Its history and development, H. S. FIRESTONE (*Akron, Ohio: Firestone Tire & Rubber Co., 1922, pp. 146, figs. 66*).—An elaborately illustrated text on rubber production and utilization as correlated with the automobile tire manufacturing industry.

DISEASES OF PLANTS.

Plant diseases found at Trinidad in December, 1921, C. G. WELLES (*Philippine Agr., 16 (1922), No. 7, pp. 348, 349*).—A brief survey of plant diseases in the large market gardens at Trinidad, Mountain Province, P. I., showed that the most serious disease prevalent was potato late blight (*Phytophthora infestans*), being regarded as the limiting factor in Irish potato production as well as in tomato production. It is easily checked by spraying with Bordeaux mixture every two weeks. The disease next in importance is cabbage black rot (*Pseudomonas campestris*). Strawberry leaf spot (*Mycosphaerella fragariae*) is noted as found only in the imperfect stage (*Ramularia tulasnei*). Celery leaf spot (*Cercospora apii*) is not serious, nor is beet leaf spot (*C. beticola*). Bean rust (*Uromyces appendiculatus*) is very serious and widespread, attacking all bean varieties but a red one of *Phaseolus vulgaris*. Sweet potato leaf spot (*Cercospora* sp.) reduces perceptibly the photosynthetic area.

Studies in the physiology of parasitism.—VII, Infection of *Berberis vulgaris* by sporidia of *Puccinia graminis*, W. L. WATERHOUSE (*Ann. Bot. [London], 35 (1921), No. 140, pp. 557-564, figs. 19*).—Studies on cuticular penetration by fungus germ tubes, as reported by Blackman and Welsford (*E. S. R., 37, p. 47*) and by Dey (*E. S. R., 43, p. 46*), were carried out to determine whether a similar behavior would be shown on the part of the fungus, in the present case *P. graminis* on *B. vulgaris*.

In the germinating sporidia a mucilaginous investment of the germ tube can be shown to be present. Penetration of the cuticle is brought about by means of a very fine style-like infection hypha, which may be put out either from the end of a definite germ tube or from a short beak-like outgrowth of the sporidium. No evidence appears of any chemical action upon the cuticle, the puncture of which appears to be brought about solely by the mechanical pressure exerted by the infection hypha as it develops from the germinating sporidium or germ tube. The sporidial beak or germ tube from which the infecting style grows is firmly fixed to the leaf surface by means of a mucilaginous investment. As soon as the infection style has penetrated the epidermal wall it swells into a

vesicle from which the mycelium arises. The entry of the parasite causes at first no visible alteration of the cell contents of the host plant.

Studies in the physiology of parasitism.—VIII, On the exosmosis of nutrient substances from the host tissue into the infection drop, W. BROWN (*Ann. Bot. [London], 36 (1922), No. 141, pp. 101-119, fig. 1*).—In previous papers of this series, as above cited, it was shown that the fungus *Botrytis cinerea*, though possessing an active cytolytic principle, was unable to act upon the cells of the host tissue so long as it was separated from them by an intact cuticle. The question remained as to a possible influence of the host on the behavior of the parasite. The present paper deals with the question of the passive exosmosis of nutrient material from the host cells through the cuticle.

The methods, as described, were applied to leaves and floral structures representing a number of plants, a large amount of the work being carried out with the petals of *Cereus spectabilis*, which offers special advantages. The data as tabulated and discussed are admittedly of limited significance, and further work has been projected.

In all the cases examined drops of distilled water which had lain on the surface of leaves and petals showed increased conductivity as compared with the original distilled water or with water which had lain for an equal time on glass slides. This increase in conductivity was accompanied in many cases by a greatly increased capacity of the drops to bring about germination of *Botrytis* spores as compared with the capacity of the original water. In some plants, however, drops so treated, though showing a comparatively high degree of conductivity, have no greater effect on germination than drops of pure water. In some cases the treated drops actually produced total inhibition of germination of the spores. In the case where increased germination effects are observed, the amount of germination runs parallel with the conductivity. The magnitude of the effects produced seems to be related to the ease or difficulty with which the plant surface becomes wet.

Studies on plant cancers.—III, The nature of the soil as a determining factor in the health of the beet, *Beta vulgaris*, and its relation to the size and weight of the crown gall produced by inoculation with *Bacterium tumefaciens*, M. LEVINE (*Amer. Jour. Bot., 8 (1921), No. 10, pp. 507-525, figs. 9*).—Of the practically important problems remaining to be solved by a study of crown gall on plants, the author here mentions a more accurate evaluation of the effects of the crown gall disease upon the final size of the infected beet and hence on the beet crop, the cause of the greater susceptibility of the sugar beet as compared with other races to the crown gall organism, the breeding of beets to obtain strains immune to crown gall infection and yet retaining the desirable marketable qualities, the cytological difference between crown gall and tuberculosis of beets and the relation of the former to animal cancer, and the relation of the soil to the health of the beet and to the size of the crown gall that it will harbor when inoculated with *B. tumefaciens*. The cultivated garden beet (*Beta vulgaris*) varieties Early Model, Egyptian Early, and Giant Mangel Wurzel, inoculated with *B. tumefaciens*, were used in these studies, which are described as testing the relation between health of the beet and size of the crown gall, and as including both pot and field experiments with different kinds of soils named.

Of pot cultures in garden soil with abundant manure, brown silt loam and manure, brown silt loam, and medium sand, the largest average weight of plants was obtained in the garden soil, and the crown galls were also the largest on these plants. The plants grown in sand weighed the least, were the smallest in size, and had the smallest crown galls. Beets grown in open-air plats gave the same results. While the weight of the individual plants

both inoculated and uninoculated varied widely, the average weight of the roots with crown gall was greater than the average weight of the normal or uninoculated roots in the same plot.

Three different types of crown gall were observed in *B. vulgaris*, namely, a smooth type, a warty type, and a mixture of the two.

The reaction of the beet to crown gall depends upon the health of the beet. With any given lot of seeds the extent of the reaction and the size of the crown gall depend ultimately upon the condition of the soil and other environmental factors.

On the germination and growth of fungi at various temperatures and in various concentrations of oxygen and of carbon dioxide, W. BROWN (*Ann. Bot. [London]*, 36 (1922), No. 142, pp. 257-283, figs. 4).—The present investigation, carried out under the auspices of the Food Investigation Board of the Scientific and Industrial Research Department, had for its object the examination of the behavior of fungi under the conditions prevailing in the practice of fruit storage. There are two methods known, respectively, as cold storage and gas storage, the former of which is now widely established in practice, the other being still in the experimental stage.

Within very wide limits, variation of oxygen pressure had little effect on the germination and growth of the ordinary fruit-rot organisms such as *Botrytis*, *Fusarium*, and *Alternaria*. The germination and growth of these organisms is retarded by carbon dioxide, this action being more marked with lower temperature, weaker nutrient medium, and dense sowing of spores. The concentration of carbon dioxide necessary to inhibit germination at ordinary temperature was determined for the commoner fruit-rot organisms for germination, both in water and in nutrient medium. The experimental results indicate that the gas storage method is most effectively used in combination with the ordinary cold storage method, and that it will give the best results when no attack of the fruit has begun previous to storage and when conditions are such that a minimum of nutrient is available to fungal spores on the surface of the fruit.

Nineteen years of culture work, J. C. ARTHUR (*Mycologia*, 13 (1921), No. 1, pp. 12-23).—A series of culture experiments with the Uredinales was begun by the author in 1899 and continued uninterruptedly until 1917, the results of this work through 19 years being embodied in 15 reports, which are indicated.

The purpose of the present article is to review this work, in order to set forth some of the objects accomplished, and especially to point out the more important of the changing conceptions of the problems forming the ground plan on which the work was projected. The cultures were undertaken as aids in a general taxonomic study of American rusts, aiming to supply a technical description as complete as possible for every known species of Uredinales in North America. Significant phases of the work are discussed in their bearings.

The culture work began with the prevalent idea that all rusts could be expected to conform in general to the well-known *Puccinia graminis*. It closed with the conviction that the rusts are far too diversified in their morphology, their numerous characters, their physiological adaptations, and their range of hosts to be represented by *P. graminis* in more than one out of numerous aspects. In this résumé of cultures only a few of the more prominent developments that should help to modify the too rigid and restricted ideas of rust species as commonly held have been brought forward.

Memoranda and index of cultures of Uredineae, 1899-1917, J. C. ARTHUR (*Mycologia*, 13 (1921), No. 4-5, pp. 230-262).—Cultures of rusts conducted under the auspices of the Indiana Experiment Station during a period

of 19 years are outlined, with tabulation of the species that were successfully grown on alternate hosts.

Unusual rusts on *Nyssa* and *Urticastrum*, E. B. MAINS (*Amer. Jour. Bot.*, 8 (1921), No. 9, pp. 442-451, figs. 6).—Study of a rust on *N. aquatica* has led to the erection of a new genus and to the change of the generic name of the causal fungus, previously known as *Uredo nyssae*, to *Aplopsora*, the resulting new combination thus being *A. nyssae*.

The second rust, occurring on *U. divaricatum* and previously known as *Aecidium dicentrae*, is indicated as the new combination *Cerotelium dicentrae*.

The behavior of telia of *Puccinia graminis* in the South, H. R. ROSEN (*Mycologia*, 13 (1921), No. 2, pp. 111-113).—Since July, 1918, the author has had under observation at and near Fayetteville, Ark., the behavior of telia of *P. graminis* on various grasses and the relationships of this spore stage to the overwintering and dissemination of the rust, in view, particularly, of the lack of barberry infections.

While the cereal grasses ordinarily do not produce viable telial material, the author has carefully checked up the viability and infectivity of this stage on *Elymus australis*, one of the common grasses of this region. After several failures protuse germination was finally obtained from material collected on April 5. This germinating material was smeared on young, moistened leaves of *Berbers trifoliata*, on which infections developed, giving pycnia typical of *P. graminis*. No data were at hand to indicate to which specialized race the telia on *E. australis* belong. Supposedly this species had not been noted previously as a host for *P. graminis*.

These telia on *E. australis* are regarded as of interest not only because they differ from the ordinary behavior of stem rust telia in this region but because they show clearly that if the telia are fully developed they can be overwintered in this region and that they are infectious.

The heteroecism of *Puccinia montanensis*, *P. koeleriae*, and *P. apocrypta*, E. B. MAINS (*Mycologia*, 13 (1921), No. 6, pp. 315-322, figs. 4).—In connection with investigations on *P. triticea* and *P. secalina*, conducted in cooperation with the Office of Cereal Investigations, U. S. D. A., attention has been given to the related rusts. The study has resulted in a partial realignment of the rusts involved. The present account relates to *P. montanensis*, *P. koeleriae*, and *P. apocrypta*, which are dealt with separately.

Miscellaneous studies on the crown rust of oats, G. R. HOERNER (*Amer. Jour. Bot.*, 8 (1921), No. 9, pp. 452-457, pl. 1).—During a somewhat extensive study of the infection capabilities of oat crown rust (*Puccinia coronata*) data were collected which are here considered, with findings which are thought important.

Urediniospores borne on the surface of oat seeds do not offer a ready means of infecting seedlings developed from these seeds. Seedlings of oats emerging through soil heavily covered with viable urediniospores are not readily infected. Under Minnesota conditions a perennial mycelium, capable of producing a new crop of urediniospores after overwintering on oats, does not exist. The situation in the case of wild grasses has not been determined. Urediniospores do not remain viable over winter on oats under Minnesota conditions, nor does continued production take place. Environmental factors influence the development of the rust on oats as well as the rate of pustule formation. Etiolation brings about the early formation of telia on oat seedlings. Anthocyanin pigment formation surrounding uredinia on infected oat leaves is a common phenomenon, though not correlated with resistance or susceptibility. The appearance of telia on seedling oat leaves is not a reliable basis for determining the resistance of oat varieties.

A disease of agave, A. CHEVALIER (*Rev. Bot. Appl. et Agr. Colon.*, 1 (1921), No. 1, pp. 21-23; abs. in *Internatl. Inst. Agr. [Rome]*, *Internatl. Rev. Sci. and Pract. Agr.*, 12 (1921), No. 10, pp. 1347, 1348).—Abnormalities reported of sisal (*Agave* spp.) are ascribed to *Colletotrichum agaves* in various regions, and particularly in parts of France.

Studies on the Cercospora leaf spot of bur clover, E. F. HOPKINS (*Phytopathology*, 11 (1921), No. 8, pp. 311-318, pls. 2, figs. 3).—A description is given of Southern bur clover, caused by the fungus *C. medicaginis*. For the control of this disease, which has been shown to be transmitted through the seed, the author tested the boiling method previously described by Duggar and Tisdale (*E. S. R.*, 32, p. 829). It was found that boiling clover seed from one to five minutes considerably injured the seed, as indicated by reduced and slower germination, and as a consequence this method of treatment is not recommended. Other experiments are said to indicate that the disease may be controlled by soaking the seed in formaldehyde.

The sources of infection of potato tubers with the blight fungus, Phytophthora infestans, P. A. MURPHY (*Roy. Dublin Soc. Sci. Proc.*, n. ser., 16 (1921), No. 25-29, pp. 353-368).—Evidence is presented that more *Phytophthora* tuber disease may follow a less severe attack of foliage blight, occurring late in the season, than results from a severe outbreak which runs a rapid course.

Conditions favorable to tuber infection may be brought about in eastern Canada, or elsewhere under similar circumstances, if potatoes are sprayed in the early part of the season but left untreated during the later portions. Under such conditions it is important to distinguish between the disease which appears in the tubers at or very soon after digging time and that which appears some time later. It is the later development of the disease which becomes serious following protracted or late outbreaks of blight. Evidence derived from field experiments in Canada and in Ireland is presented to show that the bulk of infection in the case of potatoes which develop blight in storage is contracted during the digging. It is shown that direct contact of the tubers with partially blighted foliage results in serious storage rot, though the blight does not spread to any considerable extent, if at all, from tuber to tuber even in moist pits. Soil contaminated by means of spores shed from the leaves continues capable of inducing blight in freshly dug tubers for at least 10 days. The part played by contaminated soil has been fully established by laboratory investigations, which will be published separately.

The reaction of first generation hybrid potatoes to the wart disease, C. R. ORROR and F. WEISS (*Phytopathology*, 11 (1921), No. 8, pp. 306-310).—A report is given of the degree of immunity or susceptibility to potato wart disease shown by 48 potato hybrids produced from parent plants and tested by the U. S. Department of Agriculture cooperating with the Pennsylvania Experiment Station, the reaction of the parent plants being more or less definitely known. Of the 48 hybrids reported upon 36 were more or less susceptible to wart disease, and 12 were immune in the F_1 generation.

Sclerotium disease of rice, E. DE BRAGANCA PEREIRA (*Philippine Agr.*, 10 (1922), No. 7, pp. 331-345).—The object of this work was to study the character and behavior of the causal organism of the Sclerotium stem rot disease of rice and to obtain a basis for the formulation of suggestions regarding its control, which is especially necessary in the seed beds. The Sclerotium disease of rice is said to be present in practically all of the rice-growing districts of the Philippines, causing considerable destruction in the rice fields.

Inspection of rice fields on the farms of the College of Agriculture, where this work was carried on during the college years 1919-20 and 1920-21, showed

that the disease in question (*S. oryzae*) affected in varying degrees 105 of 126 rice varieties, the immunes being listed as are those suffering the greatest injury. The study as carried on is outlined with discussion.

The Sclerotium which attacks rice plants in the Philippines was also found to infect soy bean, mountain pepper, peanut, New Era cowpea, calamisms, pepper, and sesamum. The damage to rice seedlings ran as high as 34.44 per cent, being promoted by close planting and lack of maintenance of clean cultures. Older plants transplanted in soil infected with Sclerotium produced late tillering and distorted heads. Inoculations by means of mycelium are more effective than those with sclerotial bodies. Cultures kept for a very long time on artificial media seemed to develop very slowly on the inoculated plants, producing only slight injury. Plants growing in flooded soils showed no signs of disease.

Fiji disease of sugar cane in the Philippine Islands, O. A. REINKING (*Phytopathology*, 11 (1921), No. 8, pp. 334-337, pls. 2).—The author describes the Fiji disease of sugar cane as it has been observed in the Philippines. While the cause of this disease is not definitely known, plasmodium-like bodies are said to have been observed in old and young galls produced by it. From the information at hand, it is believed that the causal factor gains entrance to the plant through the root system, and that it may remain in the soil for at least a year. The relative resistance of different species of cane is stated, the Philippine varieties being in general less subject to infection than many of the introduced ones. Thus far the Fiji disease has not been observed on the wild sugar cane (*Saccharum spontaneum*).

Tobacco wildfire in 1922, P. J. ANDERSON and G. H. CHAPMAN (*Massachusetts Sta. Bul.* 213 (1923), pp. 27, fig. 1).—The results are given of cooperative investigations on tobacco wildfire due to *Bacterium tabacum*, the experiments having been conducted in 1922 by the Massachusetts and Connecticut State Stations. Wildfire is reported to be the most destructive disease of tobacco in the Connecticut Valley.

Laboratory studies are said to show that the bacteria are able to withstand freezing in cultures, and that under some conditions they are probably able to survive the winter in the soil. Negative evidence is presented indicating that the bacteria are probably not seed borne. Experiments are said to show that the bacteria can survive the winter in diseased areas in cured leaves but probably not in leaves remaining in the field.

Suggestions for the control of wildfire include the selection of seed from plants known to be free from the disease, sterilizing the seed with corrosive sublimate in case there is any doubt of the origin of the seed, location of seed beds where the disease had not occurred in the previous year, sterilization of the soil, boards, sash, or other coverings, and keeping the plants covered with a copper-lime dust or copper-lime spray from the time they are as large as the finger nail until setting is completed. If the disease appears in the field, it is recommended that the plants should be removed as soon as observed and crop rotation should be followed wherever it is practicable.

Diseases of greenhouse crops and their control, J. J. TAUBENHAUS (*New York: E. P. Dutton & Co., 1920, pp. XV+429, pls. 82*).—The author has brought together for the benefit of teachers, students, and practical greenhouse men the data available on the diseases affecting greenhouse crops. Chapters are devoted to greenhouse soils and their management, and to cultural conditions in the greenhouse, after which the principal diseases of greenhouse vegetables and ornamentals are described, together with suggestions for their control.

Apple scab control, J. W. EASTHAM (*Brit. Columbia Fruit-Growers' Assoc. Ann. Rpt.*, 31 (1920), pp. 56-59).—Experimentation here detailed confirms the advantage of Bordeaux mixture fungicidally, also as regards a directly beneficial effect irrespective of scab control. No inclusive statement, however, has yet been justified in favor of Bordeaux mixture over lime sulphur in this connection.

Combating apple scab, W. S. KROUT (*Massachusetts Sta. Bul.* 214 (1923), pp. 29-41).—The results are given of experiments conducted for the control of apple scab. Various spray materials were tested, but the most satisfactory control as a result of two year's work was with a 3-10-50 Bordeaux mixture applied when the buds were in the pink stage followed by applications of a 1-50 lime sulphur for the calyx and succeeding sprays. Experiments showed that dry lime sulphur was as efficient as liquid lime sulphur for the preparation of the spray fungicide.

In 1922 dusting sulphur and a copper-lime-arsenate dust were compared and the dusting sulphur gave the most satisfactory control. There was said to be some russetting of the fruit where the copper-lime-arsenate was used, and the dusts did not give quite as complete control as the liquid preparations.

A spraying program for 1923 is given.

The life history and identity of *Patellina fragariae*, *Leptothyrium macrothecium*, and *Peziza oenotherae*, C. L. SHEAR and B. O. DODGE (*Mycologia*, 13 (1921), No. 3, pp. 135-170, pls. 3, figs. 5).—Pursuant to studies on the causes of decay and spoilage of small fruits in picking, shipping, and marketing, during the course of which a number of fungi were found, the pathological and economic aspects of which were reserved for a later paper, the authors herein direct attention to the importance of a full knowledge of the life history, identity, and synonymy of pathogenic fungi.

The present paper treats of the life history, morphology, and taxonomy of this particular fungus, which has been found frequently on strawberries and other small fruits and is now shown to occur on a great variety of plants and plant parts. The three stages are discussed in some detail, as is the rather extensive synonymy. The distribution and hosts are indicated.

Cross-inoculation experiments show that the fungus is a weak parasite and passes readily under favorable conditions from one host to another.

The Septoria leaf spot of *Rubus*, E. W. ROARK (*Phytopathology*, 11 (1921), No. 8, pp. 328-333).—A leaf spot of *Rubus* caused by *Mycosphaerella rubi* n. sp. was described. For its prevention, planting of disease-free stock, destruction of old canes and leaves in the fall, and, when conditions are favorable for the spread of the disease, spraying with a 3-3-50 Bordeaux mixture are recommended.

A contribution to our knowledge of soil relationships with citrus chlorosis, C. B. LIPMAN (*Phytopathology*, 11 (1921), No. 8, pp. 301-305).—A report is given of a comparative study of soil extracts from soils bearing normal and chlorotic citrus trees. The normal soils were said to exceed the others in total solids, nonvolatile and volatile solids, nitrates, calcium, and magnesium, while for the content of phosphorus, potassium, and sodium the proportions were reversed. No clue was found to offer an explanation of chlorosis based on the iron content of the two soils. Considering the recent findings of Kelley and Cummins relative to the composition of mottled and normal citrus leaves (*E. S. R.*, 44, p. 544), the author thinks that possibly there may be a correlation between the composition of the soil extracts and the cause of the disease.

Preliminary report on controlling melanose and preparing Bordeaux oil. O. F. BURGER, E. F. DEBUSK, and W. R. BRIGGS (*Florida Sta. Bul.* 167 (1923), pp. 121-140, figs. 5).—A brief account is given of citrus melanose due to *Phomopsis citri*, a fungus which is said to cause also much of the stem-end rot of citrus fruits in Florida. As a result of a survey melanose is said to be widely spread in the State, a large percentage of the fruit being infected in some counties.

For the control of melanose the authors recommend spraying the trees with a 3-3-50 Bordeaux mixture to which is added 1 per cent of oil in an oil emulsion. A spray calendar is given for the times of application and fungicides recommended for the control of this and other citrus diseases.

In a previous publication (E. S. R., 39, p. 56) thorough pruning was recommended for the control of melanose, but the authors of the present publication do not consider this practice to be economically profitable. Pruning supplemented by spraying gave the highest proportion of first quality fruit. As a result of inoculation experiments only young leaves and fruits were found subject to infection, and fruits are said to become immune early in June.

Commercial control of citrus melanose. J. R. WINSTON and J. J. BOWMAN (*U. S. Dept. Agr., Dept. Cuc.* 259 (1923), pp. 8).—A brief discussion is given of melanose due to *Phomopsis citri*, with suggestions for its control by the use of Bordeaux-oil sprays, the recommendations being based on three years' experiments on the control of this disease. A detailed account of the investigations is to be given in a later publication.

Observations in Malaya on bud rot of coconuts. A. SHARPLES and J. LAMBOURNE (*Ann. Bot. [London]*, 36 (1922), No. 141, pp. 55-70, pls. 7).—Observations in the Federated Malay States, isolation and investigation of diseased tissues, and laboratory tests as interpreted by the authors led to the conclusions that if the nutritive bud tissue of coconuts is a suitable pabulum for any saprophytic organism (bacterium or fungus), this will develop and cause symptoms usually associated with bud rot if inoculated directly into the bud tissues.

Owing to a very definite resistance exercised by the bud tissues of mature trees against infection, such organisms in the absence of suitable conditions were not developed beyond a certain stage, marked by the death of the central shoot. If the central shoot dies, and the bud is invested externally with the invading organism, the bud tissues have the power of pushing out a lateral, by means of which growth is continued to take the place of the diseased central shoot. It is regarded as proved that *Phytophthora palmivora* functions as an obligate parasite on the tender central leaves of most palms, but it has not been proved to cause rotting of the heart tissues. The authors believe that the existence of bud rot in coconut palms is not of itself proof of the presence of a specific disease, or of disease at all in the ordinary sense of the word. Bud rot is a condition which may be induced by mechanical and chemical or parasitic interference with the life processes of the palm. The material of the heart is extremely tender, and when the natural resistance of the living tissue is reduced it forms a highly nutritive medium suitable for the rapid development of any of a large variety of possible invading organisms. In the case of epidemic or infective bud rot, the issue is narrowed down to the responsibility of a transferable parasite, but there is no ground for assuming that the parasite concerned in producing the condition of such a general nature is necessarily or even probably the same in different situations.

Some problems of forest pathology in Ontario. J. H. FAULL (*Jour. Forestry*, 20 (1922), No. 1, pp. 67-70).—The problems in pathology presented by the

extensive, unregulated, and varied forest growths of Ontario are being investigated along the lines of tabulation of Ontario timber diseases and their causal agents, foundation studies on butt rots, and consideration of particular problems in response to special demands. Several diseases, hitherto undescribed, have come to light in the course of the tabulation.

Butt rots constitute an outstanding and increasing cause of loss.

Particular attention has been given to white pine needle blight, which is especially prevalent in northern Ontario, the greater part of the research on this disease having been carried out in Timagami, an area located about 300 miles north of Lake Ontario. The symptoms of the disease are described. The trouble was found in 1919 to lie in the roots, the absorbing roots being dead at a time when there was a sudden demand for a greatly increased supply of water. The killing may occur from deficiency of water. Trees other than *Pinus strobus* were affected in lesser degree. Needle blight is difficult to distinguish from sulphur-fume injury.

Regarding white pine trees studied since 1918, 358 being blighted and 275 checks, it is stated that only two of the latter developed blight, and this occurred under known conditions, namely, a partial lifting of the thin soil cover by freezing from its bed of broken rock.

Dividing arbitrarily blighted trees into two classes, those with trunks more than 6 in. in diameter and those below that class, and tabulating, it is concluded that young stands are not likely to be seriously depleted by needle blight, that injury to heavily blighted mature stands may be so great as to be a decided factor in determining the time of harvesting, and that in regions subjected to sulphur fumes, it is possible to differentiate between blight and sulphur-fume injury if the examination be made at the right time, that is, during the growing season.

Chestnut black canker, G. BRIOSI and R. FARNETI (*Atti Ist. Bot. R. Univ. Pavia*, 2. ser., 18 (1921), pp. 93, pls. 17).—Chestnut black canker is claimed to have its origin in the aerial parts and not in the roots, though it does descend into these, passing to their extremities. The fruiting bodies of *Coryneum* are not present in the final stage of vegetative life. *C. perniciosum* is identical with *C. kunzei castaneae*, and *McInconus perniciosus* with *M. modoniae*.

Leaf spots of the elm, L. E. MILES (*Bot. Gaz.*, 71 (1921), No. 3, pp. 161-196, pls. 3, fig. 1).—*Gnomonia ulmea*, the cause of the most common elm leaf spot in America, has been reported as occurring on five of the six native species of elm in this country and as being of wide distribution, extending throughout the entire range of its hosts, the most common of which is *Ulmus americana*. The fungus is not ordinarily of much economic importance, though it may cause considerable injury to seedlings and young trees in nurseries by producing premature defoliation. This fungus is discussed at some length.

A new leaf spot of the American elm is caused by *Gloeosporium ulmicolum*, which is described as a new species.

Systremma ulmi causes a leaf spot of the European elms in Europe. *Gnomonia ulmea* has been much confused with this fungus, and appears in the literature as occurring in this country. It is thought probable, however, that it does not occur at all in America.

Other species of fungi producing leaf spots on the elm are listed, with a brief comment on each of the American forms. Seven species of fungi are listed on the leaves of fossil elms.

A wet rot of Para rubber roots, W. N. C. BELGRAVE (*Fed. Malay States Dept. Agr. Bul.* 28 (1919), pp. 21, pls. 9).—In a preliminary account (E. S. R., 37, p. 458), it was claimed that Para rubber wet-rot disease is caused by *Poria*

hypolaterita. Later work has shown that the fungus could not be a *Poria*. From available material sent to Kew, the fungus has been designated as *Fomes pseudo-ferreus*. The mode and effects of infection are described. Considerable variation appears in the forms of fructifications. Successful inoculation experiments have been made on wounded roots of mature rubber. Treatment appears to be of little value. Prevention by clean clearing of jungle stumps is recommended.

Some new or little-known hosts for wood-destroying fungi, III, A. S. RHOADS (*Phytopathology*, 11 (1921), No. 8, pp. 319-326).—In continuation of his investigations (E. S. R., 40, p. 350), the author records additional new or unusual hosts for about 20 species of fungi. Notes are also given of a number of normally saprophytic forms that have been found as wound parasites on living trees.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Breeding game birds, a profitable industry, D. W. HUNTINGTON (*Trenton: New Jersey Wire Cloth Co.*, 1921, pp. 39, figs. 38).—This is a small handbook on the propagation and management of American game birds, including the methods and appliances used in rearing and in the practical protection of wild nesting birds.

Knowing birds through stories, F. BRALLIAR (*New York and London: Funk & Wagnalls Co.*, 1922, pp. XV+340, pls. 23, figs. 7).—This includes practical information presented in a popular way.

Choice of food and numerical abundance among insects, C. T. BRUES (*Jour. Econ. Ent.*, 16 (1923), No. 1, pp. 46-51).—This is a paper presented at the annual meeting of the American Association of Economic Entomologists in December, 1922.

The obligation that economic entomology owes to forestry, S. A. GRAHAM and A. G. RUGGLES (*Jour. Econ. Ent.*, 16 (1923), No. 1, pp. 51-61).—A paper presented at the annual meeting of the American Association of Economic Entomologists held in December, 1922.

The insecticidal properties of tobacco dust, P. J. PARROTT and H. GLASGOW (*Jour. Econ. Ent.*, 16 (1923), No. 1, pp. 90-95).—This is a report of investigations conducted by the authors at the New York State Experiment Station. In experiments within the spirea aphid, reground tobacco (1 per cent nicotine) of 100-, 150-, and 200-mesh fineness killed a larger percentage of the insects than the coarser grades of the material.

"Fine tobacco dust displayed a high rate of toxicity against the spirea aphid, the currant aphid, and the apple red bug. Its insecticidal properties, on an average, were not uniformly as high as that of dust mixtures containing nicotine sulphate. The rosy aphid was combated effectively with either nicotine sulphate or tobacco dust incorporated in lime sulphur and glue sulphur sprays. Unpublished data record similar results with the casein sulphur spray. In comparison, dust mixtures consisting of or containing tobacco dust and nicotine sulphate as killing agents gave less efficient control of the insect."

Further data on fumigation with hydrocyanic acid gas in greenhouses on a commercial basis, E. R. SASSER and C. A. WEIGEL (*Jour. Econ. Ent.*, 16 (1923), No. 1, pp. 84-87).—In continuation of the preliminary report (E. S. R., 47, p. 847), the authors present additional data based upon experiments conducted during the year. The formula used was 1 ounce avoirdupois of sodium cyanid, 1.5 liquid ounce of sulphuric acid (1.83 sp. gr.), and 3 fluid ounces of water. Frequent one-hour exposures in a greenhouse containing a large num-

ber of different plants were followed by no permanent injury, though temporary burning occurred on such plants as jasmine, salvia, etc., and the insects were practically eliminated, except mealybugs, which were greatly reduced by the killing of immature larvae. Results are also given for the fern scale, the camphor scale, and the Florida red scale.

[Biennial report of the State entomologist], D. C. MOTE ET AL. (*Ariz. Conn. Agr. and Hort. Ann. Rpts.*, 12-13 (1920-21), pp. 17-64, figs. 12).—In this report the State entomologist presents the details of work for the fiscal years ended June 30, 1920, and June 30, 1921, with a supplementary report covering the growing season of 1921. It includes an account of the Mexican boll weevil quarantine work, the status of the Thurberia boll weevil and its control, accounts of the Thurberia bollworm, the pink bollworm, and the automobile as a factor in spreading pests and plant diseases, etc.

[Economic insects and their control in Mississippi] (*Miss. State Plant Bd. Quart. Buls.* 2 (1922), Nos. 1-2, pp. 3-9, 11-13, 15, 16, 17, 18, fig. 1; 3, pp. 3-8, 14-19, 23-26, figs. 5).—Papers presented that relate to economic entomology in No. 1-2 include Recent Developments in Relation to the Pink Bollworm Situation in the United States, by W. D. Hunter (pp. 3-6); A New Potato Weevil in Mississippi, by R. W. Harned (pp. 6-8); The Chrysanthemum Gall Midge [*Diarthronomyia hypogaea* Leon], by D. W. Grimes (pp. 8, 9); A New Sugar Cane Borer [*Diatraea saccharalis crambidoides* Grt.], by R. W. Harned (pp. 11, 12); Argentine Ant Infestations Increase, by M. R. Smith (pp. 12, 13); Sweet Potato Weevil Invades George County (pp. 15, 16); and Mealybugs (*Pseudococcus* sp.), by J. M. Langston (pp. 17, 18). Papers presented in No. 3 include The Status of Sweet Potato Weevil Eradication in Mississippi, by K. L. Cockerham (pp. 3, 4); The Sugar Cane Moth Borer in South Mississippi [*D. saccharalis crambidoides*], by T. E. Holloway (pp. 4-8); Mexican Bean Beetle Extends Territory (pp. 14-18); The Argentine Ant Situation (pp. 18, 19); and The Buff-Colored Tomato Weevil of Australia [*Desiantha nociva*] in South Mississippi (pp. 23-26).

The paper by Harned on a new potato weevil in Mississippi calls attention to the fact that a new pest has been found in Stone County, where it destroys Irish potatoes, tomatoes, and turnips, but appears to have been readily controlled through the application of arsenate of lead. The pest appears to be *D. nociva*, the buff-colored tomato weevil occurring in Australia, an account of which by W. W. Froggatt (*E. S. R.*, 35, p. 261) is reproduced in No. 3.

Fifty-second annual report of the Entomological Society of Ontario, 1921 (*Ent. Soc. Ontario Ann. Rpt.*, 52 (1921), pp. 71, figs. 13).—This report includes papers presented at the annual meeting of the society, held at Guelph on November 17 and 18, 1920, namely, Poisoned Molasses for the Destruction of Noctuid Moths, by E. H. Strickland (pp. 13-18); The Western Wheat-stem Sawfly in Canada [*Cephus cinctus* Nort.], by N. Criddle (pp. 18-22) [*E. S. R.*, 47, p. 762]; The European Corn Borer (*Pyrausta nubilalis* Hubn.): Life History in Ontario, by H. G. Crawford and G. J. Spencer (pp. 22-26); The Spread of the European Corn Borer in Southern Ontario, by L. S. McLaine (pp. 26-28); The Imported Onion Maggot [*Hyalemyia antiqua* (Melg.)] in British Columbia, with Notes on Its Life History and Control Under "Dry Belt" Conditions, by R. C. Treherne and M. H. Ruhmann (pp. 29-33); Notes on the Plum Spider Mite or European Red Mite [*Paratetranychus pilosus* C. & F.], by W. A. Ross and W. Robinson (pp. 33-42); Insects of the Season in Ontario, by W. A. Ross and L. Caesar (pp. 42-52); The Cabbage Maggot (*Phorbia brassicae* Bouche), by L. Caesar (pp. 50-52); Economic Entomology in Quebec

during the Past Decade, by Father Leopold (pp. 52-62); and The Entomological Record, 1921, by N. Criddle (pp. 57-70).

The paper on *P. pilosus*, by Ross and Robinson, presents the results of studies of its biology, details of which are presented in tabular form. A table is given showing the number, duration, and overlapping of generations and another showing the comparative susceptibility of European plums to mite injury, classified under the headings severe, moderate, light, and very light. The authors' experiments have shown definitely that the pest can be controlled by spraying twice with commercial lime sulphur 1-40 at the times recommended for the control of brown rot, curculio, etc., namely, (1) when the fruit is set and most of the calyxes have dropped and (2) two weeks later. Preliminary experiments indicate that heavy applications of sulphur dust will also control the mite.

Insects attacking ferns in the Hawaiian Islands, O. H. SWEZEY (*Hawaii Ent. Soc. Proc.*, 5 (1922), No. 1, pp. 57-65).—Brief notes are given on the insects which attack 130 odd species of ferns occurring in the Hawaiian Islands.

The greenhouse grasshopper, *Tachycines asynamorus* Adel., a pest in conservatories and propagating houses, F. A. MASON (*Bur. Bio-Technol., Leeds, Bul.* 8 (1923), pp. 262-267, figs. 4).—A brief summary of information on this pest, a knowledge of the life history of which is very incomplete.

The use of nicotin dusts in the control of citrus thrips, A. J. FLEBUT (*Calif. Dept. Agr. Mo. Bul.*, 11 (1922), No. 10, pp. 745-754).—This account is based upon work conducted by the U. S. D. A. Bureau of Entomology during the spring of 1922 to determine the effectiveness of nicotin in a dust carrier in controlling *Scutothrips citri* Moulton. In all, about 50 acres were dusted experimentally, some as it would be done commercially, others far heavier than could be afforded. In but a single case, that of a grove at Naranjo, Calif., were the results satisfactory, and there some results must have been obtained by the destruction of *Melilotus* upon which the thrips were breeding. The failure of the dusts in successfully controlling the citrus thrips seem to be due, first, to the difficulty of distribution, good coverage being impossible in a breeze of any kind, and second, to the failure of the dust to kill the thrips, merely paralyzing them for a time, and many recovered.

The squash bug in Massachusetts, H. N. WORTHLEY (*Jour. Econ. Ent.*, 16 (1923), No. 1, pp. 73-79, figs. 2).—The author reports upon studies of the life cycle of the squash bug in Massachusetts and compares records with those for other parts of the country. An attempt to discover an efficient insecticide for its control resulted negatively. Brief notes are given on the tachinid parasite *Trichopoda pennipes* Fab., a more extended account upon which is being prepared.

The onion capsid, *Orthotylus translucens* Tucker, P. A. GLENN (*Jour. Econ. Ent.*, 26 (1923), No. 1, pp. 79-81, pl. 1).—The life cycle of the onion capsid which occurs in Illinois on wild garlic and attacks onions, is briefly summarized. Spraying with whale-oil soap is recommended. The burning over of garlic fields and fall plowing are excellent preventives.

The clover aphid: Its biology, economic relationships, and control, R. H. SMITH (*Idaho Sta. Research Bul.* 3 (1923), pp. 3-75, figs. 35).—This is a detailed report of investigations commenced at the station by the author in May, 1918, a preliminary account of which, in Bulletin 112, has been noted (*E. S. R.*, 40, p. 354). The author reports at length upon the economic history of the clover aphid (*Anuraphis bakeri* Cow.) and its importance, and follows with accounts of its life history and habits and means of control, including natural

enemies. The account has an annotated bibliography of 43 references to the literature.

Dusting for the pea aphid, E. N. CORY (*Jour. Econ. Ent.*, 16 (1923), No. 1, pp. 81-84).—The author has found dusting to be the most promising means for controlling the pea aphid in Maryland, and that a high nicotin content and not less than 30 lbs. of dust per acre are preferable. The use of a trailer of canvas is advised, and at least 50 per cent of the vines should be infested when dusting is commenced.

The outbreak of *Pseudococcus sacchari* Ckll. on the sugar cane of Egypt, W. J. HALL (*Egypt Min. Agr., Tech. and Sci. Serv. Bul.* 26 (1922), pp. [2]+16).—This is an account of a mealybug of world-wide distribution which was first observed in Egypt in 1912 and came into prominence in 1918, since which time it has increased to such an extent that the whole sugar cane crop of Egypt is affected to a greater or less degree. A brief summary of information on the pest is followed by an extended discussion of control measures.

The sugar cane mealybug, T. D. A. COCKERELL (*Nature [London]*, 111 (1923), No. 2781, p. 223).—The author refers to the account of the sugar cane mealybug (*Pseudococcus sacchari* Ckll.) above noted, and to observations made in Madeira, where only a sparing and local infestation was observed. It is thought probable that its control there is due to some efficient parasite.

The author also reports the occurrence of what he considers a really dangerous pest in Madeira, namely *Aleurothrixus howardii* Quaint., which was observed on citrus in Funchal. The rose weevil *Pantomorus fulleri* (Horn.) is said to be another potential pest found in Madeira.

Control of the common mealybug on citrus in California, A. D. BORDEN (*U. S. Dept. Agr., Farmers' Bul.* 1309 (1923), pp. 11, figs. 5).—This is a popular summary of information on *Pseudococcus citri* Risso. and means for its control.

Problems in economic entomology, E. P. FELT (*Jour. Econ. Ent.*, 16 (1923), No. 1, pp. 39-45).—This discussion deals particularly with the proposed zone barrier against the westward spread of the gipsy moth, extending northward and westward through the highly cultivated regions from Bridgeport to Danbury, Conn., thence through portions of the Harlem. Hudson, Champlain, and St. Lawrence Valleys to Lake Ontario.

The corn earworm, W. J. PHILLIPS and K. M. KING (*U. S. Dept. Agr., Farmers' Bul.* 1310 (1923), pp. 11+18, figs. 18).—This is a popular summary of information on the bollworm on corn and means for its control.

On the synonymy of the pea moth, C. HEINRICH (*Canad. Ent.*, 55 (1923), No. 1, p. 13).—The author calls attention to the fact that there are two species of *Laspeyresia* both of which are pea moths, namely, *L. nebritana* Treit., and *L. nigricana* Steph. A further study of the *Laspeyresinae* has led to the discovery that the form to which the name *L. novimundi* Heinr. was given (*E. S. R.*, 44, p. 252) is no other than *L. nigricana*.

A preliminary report on the use of creosote oil as a mosquito repellent, C. P. COOGLE (*Pub. Health Rpts. [U. S.]*, 38 (1923), No. 10, pp. 437-443, fig. 1).—Observations here reported upon indicate that creosote oil, when applied to walls and ceilings in the quantity of 1 gal. to 420 sq. ft., will noticeably repel anopheline mosquitoes. The duration of the effectiveness of creosote oil has not been determined, but observations of certain creosoted houses 10 weeks after the application seemed to indicate that the oil was still effective at that time.

***Masicera senilis*, a parasite of the European corn borer (*Pyrausta nubilalis*)**, II, W. R. and M. C. THOMPSON (*Ent. Soc. Wash. Proc.*, 25 (1923), No. 2, pp. 33-44, figs. 21).—In this second paper of the series (*E. S. R.*, 46, p.

57), the author deals at length with the tachinid parasite *M. senilis*, which in southern Italy is responsible for almost the total parasitism observed in the hibernating larvae after the emergence of the ichneumonid *Eulimneria crassifemur*, another important parasite of the corn borer. The species has been referred to by Coquillett under the name of *M. myoidea* and is indigenous to North America, where it is a common parasite of stem borers. It was described by Townsend in 1916 under the name *Andrina radialis*.

The neotropical muscoid genus *Mesembrinella* Giglio-Tos and other testaceous muscoid flies, J. N. ALDRICH (*U. S. Natl. Mus. Proc.*, 62 (1922), *Art.*, 11, pp. 24).—Among the 12 species here described as new is *Palpostoma desvoidyi*, reared from *Lepidiotia frenchii* Blkbn., a scarabaeid beetle injurious to sugar cane in North Queensland.

Note on the lesser bulb or lunate fly (*Eumerus strigatus* Fall.), D. B. MACKIE (*Calif. Dept. Agr. Mo. Bul.*, 11 (1922), No. 10, p. 759).—The author records the rearing of this fly from bulbs at Sacramento, Calif., where two broods a year were observed. It was also reared from bulbs received from Santa Cruz County, and reports of its presence in other sections have been received from bulb growers. The pest has been taken in bulb importations as follows: Bearded Iris from France, hyacinth from Holland, narcissus from France and Holland, and unnamed bulbs from Holland. It has been reported, according to the Federal Horticultural Board, from Massachusetts, New York, New Jersey, Connecticut, Texas, Ohio, Colorado, Washington, Oregon, California, and Peru. Experiments show that this species succumbs to vacuum fumigation in carbon disulphid at the rate of 2 lbs. per 100 cu. ft. for a period of an hour, with no injury to the bulbs.

On Indian parasitic flies, I–IV, H. RUSSELL (*Jour. Bombay Nat. Hist. Soc.*, 28 (1922), Nos. 2, pp. 370–380; 3, pp. 703–718, pls. 2; 4, pp. 957–969, pls. 3).—This paper, dealing with parasitism among the Diptera, includes a general discussion, an account of the structure and life history of the species which compose the families of parasitic larvae, and accounts of the parasitic forms among the Muscolidea and Pupipara.

Some recent experiments in the control of the cabbage maggot (*Chorthophila brassicae* Bouche), W. H. BRITTAIN (*Jour. Econ. Ent.*, 16 (1923), No. 1, pp. 61–68).—The author reports upon experiments with a number of compounds for the control of the cabbage maggot extending over a period of eight years. They have shown that considerable latitude in the use of corrosive sublimate is allowable, and that even under adverse weather conditions there is no necessity for applying the treatment until several days after the flies appear. It has also been demonstrated that the application remains effective for some time, and the same is true of treatments with creosote or anthracene oil dust, though not to the same extent.

Control of the root maggot in cabbage seed beds, H. GLASGOW (*Jour. Econ. Ent.*, 16 (1923), No. 1, pp. 68–73, fig. 1).—This is a report of a comparison of methods, conducted by the author at the New York State Experiment Station. In western New York control of the cabbage maggot resolves itself largely into the protection of late cabbage while still growing in the seed bed.

“Comparisons of the mercuric chlorid and cheesecloth methods are decidedly in favor of the former as regards cost and adaptability, although the method has still to prove its worth during seasons of maximum abundance of the insect. Certain precautions must also be observed, since there is danger of burning just as the young plants are pushing through the ground. No other materials tested, except tobacco dust, gave great promise of success.”

The Colorado potato beetle in the Gironde, J. FEYTAUD (*Compt. Rend. Acad. Agr. France*, 8 (1922), No. 25, pp. 705-709; *abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr.*, 13 (1922), No. 8, pp. 1056, 1057).—This is an account of the occurrence of *Leptinotarsa decemlineata* in the Department of the Gironde, where it was discovered about the middle of June, 1922, and is thought to have been introduced more than a year previously. At the time of the discovery numerous fields had been invaded throughout almost the whole of the Canton of Blanquefort and of Castelnau in the south. Control work was commenced, arsenate of lead being placed at the disposal of farmers by the Government free of cost.

A coffee borer, J. DE CAMPOS NOVAES (*Bol. Agr. [Sao Paulo]*, 23. ser., No. 3-4 (1922), pp. 67-70, figs. 4).—Under the name *Xyleborus coffeicola* the author describes a new species that is a source of injury to coffee in Brazil.

Premature dropping of the coconut caused by *Homalinotus coriaceous* Gyl., G. BONDAR (*Chacaras e Quintaes*, 25 (1922), No. 3, pp. 205-208, figs. 5).—The attack of this curculionid beetle results in the abortion of the fruit of the coconut palm in Brazil.

The leaf and twig mining buprestid beetles of Mexico and Central America, W. S. FISHER (*U. S. Natl. Mus. Proc.*, 62 (1922), Art. 8, pp. 95).—In studies of the buprestid beetles of the tribes Agrillini (group Trachytes) and Mastogenini, from Mexico and Central America, the author has recognized and described 42 new species. The genus *Lelopleurella* is erected.

Cotton boll weevil in Virginia, W. J. SCHOENE (*South. Planter*, 84 (1923), No. 5, pp. 2, 28).—The author announces the discovery of the invasion of Virginia by the boll weevil at two points, (1) in the southern corner of Pittsylvania County close to the North Carolina line and (2) somewhat south of Suffolk in Nansemond County.

Starting right with bees, H. G. ROWE (*Medina, Ohio: A. I. Root Co.*, 1922, pp. 128, figs. 122).—This paper gives practical information based upon personal experience.

Forty-second annual report of the Beekeepers' Association of the Province of Ontario, 1921 (*Ontario Dept. Agr., Beekeepers' Assoc. Ann. Rpt.*, 1921, pp. 80).—The papers presented at the forty-first annual convention held at Toronto in November, 1921, together with the discussions which followed, are given.

Descriptions of new genera and species of Hawaiian Encyrtidae (Hymenoptera), III, P. H. TIMBERLAKE (*Hawaii. Ent. Soc. Proc.*, 5 (1922), No. 1, pp. 135-167, figs. 17).—This paper is said to complete the author's consideration of Hawaiian Encyrtidae (E. S. R., 43, p. 662), except the endemic species of *Anagyrus*. The genera here treated all belong to the Mirini, and the new species are apparently endemic.

The biology of *Habrobracon brevicornis* Wesm.; a contribution to the question of the biological control of injurious insects, A. HASE (*Arb. Biol. Reichsanst. Land. u. Forstw.*, 11 (1922), No. 2, pp. 95-168, pls. 6; *abs. in Rev. Appl. Ent.*, 10 (1922), Ser. A, No. 11, pp. 566, 567).—This is a report of investigations of *H. brevicornis* conducted from August to December, 1921, as a result of the occurrence of this braconid in broods of the Mediterranean flour moth. Observations of its life history here reported show that several generations can occur during the year, and at high temperatures a new one can appear in seven days. Although a relatively high degree of warmth is required, its economic value is considerable. Its development is slow under 64° F., and oviposition ceases in cool weather.

A new hymenopterous parasite of the Australian fern weevil, *Syagrius fulvitaris* Pasc., D. T. FULLAWAY (*Bul. Ent. Research*, 13 (1922), No. 2, p. 201).—Under the name *Ischogonus syagrii* n. sp. the author describes a hymenopteran reared from the larvae of *Syagrius fulvitaris* Pasc. at Nimbin, New South Wales.

The language of bees, K. VON FRISCH (*Zool. Jahrb. Abt. Allg. Zool. u. Physiol. Tiere*, 40 (1923), No. 1-2, pp. 186, pls. 2, figs. 25).—This is a report of an extended investigation in animal psychology. A bibliography of 39 titles is included.

Results of spraying and dusting for the control of the red spider (*Paratetranychus pilosus*), D. M. DELONG (*Jour. Econ. Ent.*, 16 (1923), No. 1, pp. 88-90).—Control work with the red spider in the Erie-Chautauqua fruit section, where it has become a serious pest on several types of fruit trees, is reported. The mites appear on the foliage early in the spring and develop from egg to adult in two to three weeks, there being such an overlapping that eggs and adults are always present. As a result effective dusts must remain active upon the foliage for some time. It was found that lime sulphur wash, 1 to 40, easily controls the pest, though it is too strong for prune foliage, which at times may be seriously injured by 1 to 75.

"The control by various sulphur dusts in combination with arsenate of lead or nicotine did not vary greatly, ranging from 50 to 60 per cent. Soap added to lime sulphur wash increases its value by at least 5 to 10 per cent. A 1 per cent lime sulphur with 6 lbs. of sulphur paste for each 100 gal. and 1 lb. of resin fish-oil soap gave very satisfactory control."

FOODS—HUMAN NUTRITION.

Report of the scientific committee appointed to direct the work of the research center for the nutrition of man and animals (*Bul. Soc. Sci. Hyg. Aliment.*, 10 (1922), No. 7, pp. 403-414).—At a meeting held at the headquarters of the Scientific Society of Alimentary Hygiene June 30, 1922, it was reported that the Institute of Agricultural Research had entrusted to the society that part of its program which deals with the nutrition of man and animals, and had made a grant of 30,000 francs for 1922. The proposed organization and personnel were indicated, the work to be divided between the laboratory of physiological chemistry and the calorimeter laboratory. The lines of investigation to be followed by the society in the research center thus established were discussed by the committee.

Commission for the study and organization of a technical school of food preservation (*Bul. Soc. Sci. Hyg. Aliment.*, 10 (1922), No. 7, pp. 395-402).—This is a report, with summary of discussions, of a meeting held at Paris June 26, 1922. It includes a proposed outline of instruction in the theory and technique of food preservation and in food legislation to be given in such a school, the organization of which is being considered by persons interested from commercial and scientific points of view.

Comparative food needs of man and domestic animals, A. M. LEROY (*Bul. Soc. Sci. Hyg. Aliment.*, 10 (1922), No. 7, pp. 415-433, figs. 4).—The so-called "feed units" and "feed equivalents" proposed for the practical use of French cattle raisers are here described, and similar "food units" for human beings are worked out, by applying the factors representing the specific dynamic action of protein and carbohydrates to the commonly accepted energy values for food materials.

The modern conception of nutrition and some of our food problems, M. L. ROXAS (*Philippine Agr.*, 10 (1922), No. 10, pp. 447-465).—This paper

includes a brief discussion of modern developments in nutrition, followed by a careful analysis of the diet of the Filipinos, with suggestions for its improvement.

The figures on which this discussion is based include dietary studies covering a period of one year, with weekly observations, of three typical peasant families; similar dietary studies carried on consecutively from June, 1919, to March, 1920, of a student mess of the College of Agriculture of the University of the Philippines; and a still more recent study of the same student mess when the diet was better. The data for the three peasant families were calculated as the average per man per day on the basis of men at moderately active work 1, women 0.8, and children of different ages from 0.8 to 0.8 man value, and included weight, protein, calories, and calcium furnished by the different groups, meat and fish, eggs, milk, grain products, vegetables, and sugar. The diets of the three families furnished on the average 70.3 gm. of protein, 2,097.6 calories, and 0.1274 gm. of calcium per man per day. The diet at the student mess (first study) furnished 505.6 gm. of carbohydrate, 37.88 of fat, 13.93 of ash, 78.1 of protein, and 2,675.27 calories. The later mess furnished 85.5 gm. of protein and 2,817.4 calories. Calculated to 50 kg. body weight the peasant dietaries furnished 70.4 gm. of protein and 2,247 calories and the student mess 78.1 gm. of protein and 2,675 calories.

A comparison of the types of food and their distribution in the American diet, as estimated by Sherman, and in that of the students' mess is given in the following table:

Relative source and cost of calories furnished by American and Filipino dietaries.

Kind of foodstuff	American dietary.		Filipino dietary.	
	Calories.	Cost	Calories.	Cost.
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Meats and fish.....	16.54	33.19	11.35	31.30
Eggs.....	1.75	5.55	2.22	9.04
Milk.....	8.11	9.08	.78	2.41
Cheese.....	.94	1.13		
Butter and other fats.....	10.29	8.14	.50	1.56
Grain products.....	37.79	17.85	75.16	31.81
Sugar and molasses.....	10.78	3.80	2.40	1.16
Vegetables.....	9.03	9.12	7.06	20.67
Fruits.....	3.87	6.03		
Nuts.....	.27	.35		
Miscellaneous.....	.63	5.76	.53	2.05

In discussing these and the other figures presented, the author concludes that the Filipino dietary is probably deficient in protein (because of low intake), in vitamins, and in calcium, and suggests as methods of remedying these deficiencies "the encouragement of a greater and cheaper vegetable production and the fostering of the dairy industry in the Islands."

Studies in the diet of the Korean people, J. D. VANBUSKIRK (*Severance Union Med. Col., Research Dept., Seoul [Keijo], Art. 14, pp. 10*).—This report of preliminary investigations as to the amounts and kind of food eaten by the Korean people and its nutritional value contains a descriptive list of the principal Korean foods, with methods of their preparation and data on the actual food consumed for a period of one month by 23 young men, mostly students, and on the nitrogen balance of a number of subjects. Most of the subjects lived in boarding houses and a few in private homes. They are described as being vigorous and healthy, getting some exercise, but not laboring. The food values

as reported are at best only approximate, as they were obtained by calculations from the weight of food consumed and analyses of similar foods.

Rice and rice mixtures averaged 1,572 gm. per day, furnishing 1,885 calories out of an average of 2,866. The range in calories was from 1,774 to 3,359. Protein ranged from 67 to 130 gm., with an average of 89 gm. or about 15 per cent of the diet. The nitrogen values in the urine showed that only about 75 per cent of this protein was utilized. While no analyses of inorganic salts were made, it is considered that with the amount of vegetable and leafy foods used there was no marked deficiency in salts. It is estimated that the diet contains an abundance of vitamins B and C, but a deficiency of vitamin A. This is largely due to the fact that milk and butter are not used to any extent.

Famine rations in Russia, S. DEJUST (*Bul. Soc. Sci. Hyg. Aliment.*, 10 (1922), No. 7, pp. 434-455, pls. 2, figs. 7).—This article summarizes the available reliable information regarding food conditions in famine areas of Russia and the physiological effects of famine.

Native dietary on Niue Island, A. B. JUNIPER (*Jour. Home Econ.*, 14 (1922), No. 12, pp. 612-614).—The author summarizes her observations on diet in this South Pacific island. Taro, coconuts, fish, and bananas are among the foods commonly used. Some of the cooked dishes and their preparation are described. Eggs are not used by the natives, it is said, though chicken is an important feature of all feasts, but rarely eaten at other times. "To sum up, the dietary is starchy and bulky, low in protein, high in fat from the coconut. The people look well nourished but not overfed, and are noted for being the best workers among the Pacific natives. Venereal and skin diseases, first introduced by whites, are prevalent, but apart from these the natives are a healthy people."

Urundi, territory and people, H. L. SHANTZ (*Geogr. Rev.*, 12 (1922), No. 3, pp. 329-357, figs. 25).—Information is included in this report regarding animal and vegetable food products, markets and marketing, food preparation, and related matters in Urundi, east Africa.

Discussion on basal metabolism, E. P. CATHCART (*Brit. Med. Jour.*, No. 3225 (1922), pp. 747-750, fig. 1).—In this opening paper of a discussion on basal metabolism at a meeting of the British Medical Association held at Glasgow in July, 1922, the author discusses some of the problems that must be considered in the interpretation of the results obtained in the determination of basal metabolism. His conception of basal metabolism is that "the true basal metabolism is a phenomenon separable from metabolism in general, and that it is based for the most part on the sarcoplasm or 'tonus' metabolism. It is generally admitted to be the lowest limit of metabolism compatible with normal tissue activity, and that it is certainly a function of the mass of the active metabolic tissue, of which muscle is the predominant material."

A self-registering respiratory apparatus for determining the absorption of oxygen and caloric exchanges in man, A. KROGH (*Compt. Rend. Soc. Biol. [Paris]*, 87 (1922), No. 25, pp. 458-461, figs. 2).—A simple apparatus is described and illustrated by means of which oxygen consumption is recorded automatically on a kymograph connected with a spirometer, which in turn is connected with a gas mask into which the subject breathes. Comparisons of the results obtained on the same subject with this apparatus and those obtained by measurement and analysis of the expired air are said to have shown very satisfactory agreement.

The oxygen consumption during running, A. V. HILL and H. LUPTON (*Jour. Physiol.*, 56 (1922), No. 5, pp. XXXII, XXXIII).—Observations by the Douglas bag method are reported of the O₂ consumption and the CO₂ elimination by a subject running at different speeds around an open-air track 92.5

yds. in circumference. The subject was a man 35 years old, weighing 73 kg. and used to running, although not classed as a first-class runner. The oxygen consumption varied from 422 cc. per minute at rest to 4,175 when running at 9.1 miles per hour. After another rest period in which the oxygen consumption was 373 cc. per minute, running at 10 miles an hour raised the value to 4,055. Corresponding values for carbon dioxide were 356 to 4,475 and 328 to 4,335 cc. At both of the high values more carbon dioxide was evolved than oxygen consumed, the ratio $\text{CO}_2 : \text{O}_2$ being 1.07.

Nonprotein nitrogen of blood in health and disease, O. FOLIN (*Physiol. Rev.*, 2 (1922), No. 3, pp. 460-478).—This is a review and discussion of the literature on the subject, with an appended bibliography of 45 titles.

Nutrition on high protein dietaries, J. C. DRUMMOND, G. P. CROWDEN, and E. L. G. HILL (*Jour. Physiol.*, 56 (1922), No. 6, pp. 413-420, figs. 2).—Rats and kittens were used as the experimental animals in a comparative study of the effect on growth and well-being of normal and high protein diets. In the case of rats, the normal diet used consisted of caseinogen 20, starch 50, yeast extract 5, lemon juice 5, butter 15, and salt mixture 5 parts, and the high protein diet of caseinogen 83, yeast extract 5, lemon juice 5, shark liver oil 2, and salt mixture 5 parts. Rats from 20 to 30 days old and weighing about 40 gm. were used for the study, animals from the same litter being used for the two diets.

Growth curves are given of one male and one female on the normal diet and of two animals of each sex on the high protein diet. The latter showed for about 30 days the same rate of growth as those on a normal diet. At this period there was temporary retardation, followed later by resumption of growth, but at a slower rate. At the age of 130 days the average weights of a group of six controls and 13 on the high protein diet were male rats normally fed 242 gm., high protein diet 142, and females 175 and 135 gm., respectively. At the conclusion of the experiment the animals on the high protein diet looked well and on autopsy the organs appeared to be normal. The ribs showed marked beading and the contents of the abdominal cavity had an objectionable odor. The groups on the balanced diet produced and reared normal litters, but there was no disposition to breed on the part of the animals on the high protein diet.

Similar experiments were conducted on kittens as representative of *Carnivora*. The normal diet consisted of raw beef (fat and lean) from 110 to 170 gm., with bread and milk ad libitum, and the high protein diet of raw lean beef from 110 to 170 gm., yeast extract from 2 to 4 gm., shark liver oil 4 cc., and salt mixture 2 gm. One male and one female were used as controls and two females fed on the high protein diet. The latter showed retardation of growth early in the experiment and continued to grow at a subnormal rate. At the end of 4 months one of the animals was killed and autopsied, with results similar to the rats on the high protein diet. The other was then given the normal diet and immediately responded with a rapid increase in growth rate.

In discussing these results, attention is called to the studies of Hartwell along similar lines (*E. S. R.*, 47, p. 858). It is noted that some of the typical symptoms observed by this investigator have been obtained by one of the present authors, but only in the case of animals reared by mothers on diets deficient in vitamin B. It is stated in conclusion that "the failure to grow normally and to reproduce is in our opinion due not to the high protein intake itself, but to a lack of balance between this constituent and some other component or components of a normal diet. It is tentatively suggested that the vitamin B, which is believed to be quantitatively concerned in the metabolism

of carbohydrates, may likewise be concerned in the metabolism of those non-nitrogenous fragments of the amino acids which follow a similar fate."

On the constancy of the creatin-creatinin excretion in children on a high protein diet, V. J. HARDING and O. H. GAEBLER (*Jour. Biol. Chem.*, 54 (1922), No. 3, pp. 579-587).—This paper reports the results of an investigation of creatin-creatinin excretion in normal children on a high protein diet of cereals, eggs, bread, butter, milk, potatoes, vegetables, sugar, and oranges. Three groups of 4 children each, 2 boys and 2 girls, were used for the study, the ages of the groups ranging from 2½ to 3½, 4 to 4½, and 9 to 9½ years. The average creatin and creatinin excretion for a 3-day period for each child is given, together with the so-called creatinin and total creatin coefficients. The latter represents the ratio of milligrams of creatin plus creatinin in terms of creatin to the body weight in kilograms.

The creatinin coefficients ranged from 10.1 to 18.2, rising definitely with increasing age and weight. The total creatin coefficient showed a marked constancy at an average of 23.1 regardless of age, the averages for the three groups being 23.2, 22.1, and 23.9. It is pointed out that these figures are of the same magnitude as the creatinin coefficient of an adult man.

These findings are interpreted as indicating that "creatin is produced from protein either in toto or from a special fraction of it, is stored in the muscles, and is converted into creatinin. With the saturation of the muscles with creatin, any excess production will find its way into the urine, and, provided the dietary protein is not reduced to such a low level that a condition of protein starvation occurs, the urinary creatin will appear as a waste product of exogenous origin. If, however, the constancy of the total creatin coefficient when upon a high protein diet is admitted, it would involve the conclusion that creatin production reaches a maximum, and that once that maximum is reached no amount of further feeding of protein, however excessive, will result in an augmented creatinuria. Similarly, moderate decreases in protein intake may fail to lower or abolish an existing creatinuria."

With regard to the influence of age and sex upon creatinuria, the figures reported for the creatinin coefficient when compared with the total creatin coefficient would indicate that on the average creatin will disappear from the urine of both boys and girls at about the age of 16 years if each sex develops a muscular system to the same degree.

A comparison of the results obtained on normal children with tabulated results from various sources on creatinuria in pathological conditions in adults shows the same general results, the total creatin coefficient averaging 21.9.

Antidote to the toxic effects of excess protein diet during lactation. G. A. HARTWELL (*Lancet* [London], 1922, II, No. 19, pp. 963, 964, fig. 1).—This is a brief note to the effect that the harmful results to the young of high protein feeding of lactating rats (*E. S. R.*, 47, p. 858) can be obviated by the addition of foodstuffs or extracts rich in vitamin B.

Mammary secretion.—IV, The relation of protein to other dietary constituents, G. A. HARTWELL (*Biochem. Jour.*, 16 (1922), No. 6, pp. 825-837, figs. 5).—Essentially noted above.

Sources of iodine in our food supply. S. WOODRUFF (*Jour. Home Econ.*, 15 (1923), No. 1, pp. 33, 34).—A concise summary of data.

Studies on calcium and magnesium metabolism in normal women. L. J. BOGERT (*Abs. in Jour. Home Econ.*, 14 (1922), No. 12, pp. 619, 620).—The experiments here discussed have been noted from another source (*E. S. R.*, 48, p. 755).

Studies in inorganic metabolism.—IV, The influence of yeast and butter fat upon magnesium and phosphorus assimilation, L. J. BOGERT and R. K.

TRAIL (*Jour. Biol. Chem.*, 54 (1922), No. 4, pp. 753-761, fig. 1).—This paper supplements the third of the series (E. S. R., 48, p. 756) by data on the magnesium and phosphorus metabolism of the same subjects during the same experiment, with the exception that in the second period data were available for only three of the subjects.

In two of the three subjects whose calcium balances were favorably affected by the addition of yeast to the vitamin-free diet, the same favorable influence was noted in the magnesium and phosphorus balances. In the subject whose calcium balance was not altered by yeast the same proved to be true for magnesium, but there was a greater retention of phosphorus.

The substitution of butter fat for lard was followed in all four subjects by diminished fecal and total excretion of phosphorus and magnesium, as was the case with calcium. It is concluded that these results suggest some relationship between the vitamin content of the diet and the assimilation of calcium, magnesium, and phosphorus, but that other factors than vitamins present in the yeast and butter fat may possibly be operative.

Feeding experiments in connection with vitamins A and B.—III, Milk and the growth-promoting vitamin. IV, The vitamin A content of refined cod liver oil, A. D. STAMMERS (*Biochem. Jour.*, 16 (1922), No. 5, pp. 659-667, figs. 5).—The first series of experiments reported differs from the usual vitamin experiments in that instead of very young animals the rats used were in most cases survivors of a previous experiment on deficient diets and averaged 150 days of age at the beginning of the experiment and 80 gm. in weight. Eight of the 10 animals showed marked signs of ophthalmia and general debility, and the other 2 similar symptoms but to a less extent. They received during the experimental period of 111 days a basal diet deficient in vitamin A, with 2 cc. of milk from stall-fed cows as the only source of this vitamin.

On this diet all of the animals recovered from the ophthalmia and improved remarkably in general condition. The average increase in weight during the period was 38 gm., as compared with 43 gm. considered to be the normal increase in weight for this period. These results are considered to compare favorably with the classic experiments of Hopkins with the same amount of milk, and also to indicate that "the curve of normal growth remains constant, within limits, for age and not for weight. If for any reason the growth impulse has been inhibited, an attempt at restoration of the impulse by however powerful a stimulus can not succeed to an extent greater than that which would be expected from the age of the animal."

In the second series of experiments the efficacy of cod liver oil as a source of vitamin A was tested in a somewhat similar manner. Two samples of cod liver oil, one more highly refined than the other, were tested on mature rats which in three experiments had been on a diet deficient in vitamin A and in one on a complete diet. In comparing the rats which had been on the control diet with those of the same age on the partially deficient diet, the average increase in weight for the entire period was 32 and 61 gm., respectively, while the normal increase for animals of that age is given as 37. Two other groups starting at 135 days after a period on a deficient diet gained 33 and 54 gm., respectively, as compared with a normal increase of 41 gm. Two other groups of animals just weaned gave increases of 87 and 108 as compared with 141 and 144 gm.

These results are in general thought to confirm the theory advanced in the first part of the paper that the slower growth of the older animals was due to the slowing up of the growth impulses with increasing age.

Opsonins and diets deficient in vitamins, G. M. FINDLAY and R. MACKENZIE (*Biochem. Jour.*, 16 (1922), No. 5, pp. 574-577).—Rats fed on diets deficient in

vitamins A and B, respectively, were tested for the opsonic activity of their sera for *Bacillus coli* and *Staphylococcus aureus*. No significant difference was observed in the readings obtained with the sera of the animals on the complete and the deficient diets. Similarly, guinea pigs fed a diet deficient in vitamin C showed no change in the opsonic activity of their sera.

Remarks on deficiency in vitamin A and other deficiencies, H. SIMONNET (*Bul. Soc. Sci. Hyg. Aliment.*, 10 (1922), No. 6, pp. 356-364, figs. 2).—Various points brought out more or less indirectly in the author's studies of deficient diets are discussed in a general manner, with a few growth curves.

It is noted that on diets deficient in vitamin A the onset of xerophthalmia takes place at about the same time in both male and female rats, but the effect of lack of vitamin A on growth is noticed more quickly and to a greater extent in females than in males. It has also been observed that a male on a diet deficient in vitamin A can fertilize a female on a normal complete diet, but the female on a diet lacking in vitamin A remains sterile when mated to a male capable of fertilizing a normal female.

As a possible explanation of these differences it is pointed out that in the male rats the development of the testicles proceeds in a regular manner, while in the female the ovaries develop very rapidly at the age of about two months. During the time in which there is a gain of about 69 per cent of the entire weight the increase in weight of the ovary is about 460 per cent. It is during this critical period that the effects of lack of vitamin A are most noticeable.

Ocular manifestations of the rat which result from deficiency of vitamin A in the diet, A. M. YUDKIN (*Jour. Amer. Med. Assoc.*, 79 (1922), No. 27, pp. 2206-2208).—In order to examine in detail the progressive ocular changes in animals on a diet deficient in vitamin A, 5 groups of rats were fed various diets as follows: One group serving as control was fed a mixed diet. Two groups were fed a diet devoid of vitamin A, and the first of these groups was killed when the animals showed an excessive lacrimation with beginning photophobia, and the second when the eye condition had progressed to a stage at which the cornea showed signs of dryness. A fourth group received a diet lacking in vitamin A and in some cases also in vitamin B, and the animals in this group were killed at a still later stage when they showed a condition of extreme nutritive decline. A fifth group, also serving as a control, was fed a vitamin A-deficient diet until the eye condition became severe and then received cod liver oil, butter fat, or orange juice. At the end of the experimental period the animals were killed by chloroform and the eyes, the upper and lower lids, the lacrimal glands, and the orbital fat dissected out and fixed in Zenker's fluid.

The progressive changes in the eye are described somewhat as follows: The first sign is considered to be excessive lacrimation accompanied by increasing photophobia. As lacrimation increases it becomes more viscid, a slight edema of the eyelids becomes manifest, and the lacrimal secretion accumulates under the lids in the form of crusts.

The cornea is said to show no changes in the early stage except congestion at the junction of the conjunctiva, but later patches appear upon it and it becomes dry, lusterless, and opaque. The fatlike plaques which appear upon the cornea can at first be removed without destruction of the cornea, but later ulceration takes place. The iris shows little change at first, but becomes congested in the later changes.

Comparing these changes with similar clinical conditions in man, the author states that "the incipient changes in the eyes of rats showing nutritive disturbances on diets deficient in vitamin A are like the condition known as xerosis of the conjunctiva and cornea in man, and the more advanced picture is that of keratomalacia."

On the significance of vitamin A in the nutrition of fish, K. H. COWARD and J. C. DRUMMOND (*Biochem. Jour.*, 16 (1922), No. 5, pp. 631-636, figs. 6).—Starting with the ova of brown trout, the authors have studied the content of vitamin A in the fish through the larval stage.

The eggs themselves proved rich in vitamin A, two eggs per day per rat being sufficient to cause resumption of growth. By the use of a boat-shaped receptacle, through which a small stream of water could be kept circulating, it was possible to simulate normal conditions so that the eggs hatched and the larvae developed normally. About half way through the larval period, during which time no food was supplied, the larvae were again tested for vitamin A. At this point one fish per rat per day was sufficient to induce resumption of growth. After 4 weeks, when the yolk sacs were entirely absorbed, one fish proved entirely insufficient to cause resumption of growth in rats, thus indicating that in the absorption of the yolk sac the vitamin had been exhausted.

At this point the fish were divided into three groups, one of which was fed a diet rich in vitamin A, consisting of fresh minced rat liver and ground-up yolk of hard-boiled egg, one a diet of freshly ground cod muscle deficient in vitamin A, and one no extra food. The fish in the first group grew rapidly. Those in the second group did not grow much, and those in the third group not at all. In the second and third groups there were a large number of deaths. When fish of the three groups were fed to rats as the only source of vitamin A, resumption of growth occurred with the first group but not with the others. On feeding the survivors of group 2 with egg yolk pulp they began to grow again, and when used as test material showed that their tissues had again become stored with vitamin A. When those which had been previously starved were fed for 10 days with egg they served as a good source of vitamin A for rats.

Attention is called to the fact that the period at which the yolk sac is absorbed is the critical period in the rearing of young trout, and the possibility is suggested of overcoming this difficulty by feeding the young fish at this time food rich in vitamin A.

On the existence of a hitherto unrecognized dietary factor essential for reproduction, H. M. EVANS and K. S. BISHOP (*Science*, 56 (1922), No. 1458, pp. 650, 651).—A brief report is given of an investigation which is considered to demonstrate the existence of a dietary factor other than vitamins A, B, and C which is essential for reproduction.

It has been found that rats which have been maintained on a diet of casein 18, corn starch 54, lard 15, butter fat 9, and salts 4 parts, with 0.4 gm. daily of dried whole yeast (such a diet furnishing adequate amounts of vitamins A and B) are chiefly sterile in the first generation and wholly so in the second. This sterility is marked by failure not of ovarian but of placental function. The ova are fertilized and implanted, but the placentas are abnormal and resorption invariably takes place. The fertility of the rats may be restored by adding to their food such substances as fresh green leaves of lettuce, alfalfa (fresh or dry), a high percentage of butter fat, and ground whole wheat. The argument upon which the authors base their belief that the substance necessary for reproduction is not identical with the hitherto recognized vitamins is as follows:

That it is not identical with vitamin A is shown by the fact that the persistence of fertility can be demonstrated on diets when deficiency of vitamin A is proved by a test which is considered to be much more delicate than the growth test, namely, a highly characteristic aberration of the estrous cycle. Moreover, cod-liver oil, which has been proved to be much richer than butter fat in its content of A, is less efficient as a reproductive factor. The fact that ground

whole wheat, which is deficient in C, is a good source of the new factor is considered sufficient proof that it is not vitamin C. That it is not identical with vitamin B is thought to be demonstrated by the fact that the addition of as much as 25 per cent by weight of yeast to the diet causing sterility did not change the result.

An amino acid deficiency as the primary etiologic factor in pellagra, J. GOLDBERGER and W. F. TANNER (*Jour. Amer. Med. Assoc.*, 79 (1922), No. 26, pp. 2132-2135).—Further evidence that a protein or amino acid deficiency is the principal etiological factor in pellagra (E. S. R., 47, p. 65) is presented in the reports of three cases of pellagra developing at the Georgia State Sanitarium on diets whose only deficiency appeared to be that of protein. One of these cases is of particular interest in that what appeared to be an initial attack developed in a patient who for a period of 3 months immediately preceding the onset of the disease had been on a liquid diet furnishing 1,900 calories, and in which all of the protein was in the form of fresh milk (710 cc. daily). On decreasing the milk the symptoms of pellagra became more marked, while a change in diet involving an increase of the protein was followed by prompt improvement and disappearance of the pellagrous symptoms. The diet of this patient had contained no corn in any form for at least 17 months.

Experimental polyneuritis and inanition, G. MOURIQUAND, P. MICHEL, and NICODÉVITCH (*Compt. Rend. Soc. Biol. [Paris]*, 87 (1922), No. 22, pp. 168, 169).—To refute the suggestion that polyneuritic pigeons are suffering from inanition, a table is given of the quantity of food ingested and the dates of appearance of symptoms and of the death of pigeons receiving from 5 to 20 gm. of polished rice daily. The data show the earliest appearance of symptoms in those actually consuming the largest amount of rice.

The rôle of inanition in the development of polyneuritis in pigeons on a polished rice diet, E. WEILL, F. ARLOING, and A. DUFOURT (*Compt. Rend. Soc. Biol. [Paris]*, 87 (1922), No. 22, pp. 169, 170).—Further evidence that inanition plays no rôle in the development of polyneuritis in pigeons is presented in the report of a series of experiments in which pigeons were forcibly fed polished rice in known amounts. Following the feeding about 1.5 cc. of water was introduced into the crop of each pigeon to moisten the food. On autopsy the crops were opened and contents weighed. In the pigeons receiving regularly 10 gm. per day, the largest quantity of rice found in the crop was 17 gm. in the moist state or 13 gm. of dried material, as compared with from 7 to 10 gm. in the moist state which is ordinarily found in the crop. It is concluded that there is no appreciable retention of the rice in the crop.

The present status of experimental rickets, N. SIMMONDS (*Jour. Home Econ.*, 14 (1922), No. 12, pp. 601-611).—A digest of data on the relation of food and other factors to the incidence of rickets.

The etiology of scurvy, E. B. VEDDER (*Military Surg.*, 49 (1921), Nos. 2, pp. 133-150, figs. 9; 5, pp. 502-512, figs. 8).—In this investigation of the chemical properties of the antiscorbutic vitamin, the basal diet for the guinea pigs used as experimental animals consisted of oats, mixed scratch feed, bread, sterilized milk, and hay. On this diet the young animals gained weight regularly for about 15 days when scurvy developed with great regularity, the animals losing weight rapidly and dying usually before the thirtieth day. The daily addition to the basal diet of 5 gm. of green grass or 5 cc. of filtered orange, lemon, or grapefruit juice prevented the development of scurvy.

The solubility of the vitamin in various solvents was tested by evaporating orange or lemon juice to a gummy consistency by a current of air from an electric blower, extracting the residue with the solvent to be tested, and testing on

guinea pigs the extract thus prepared. As thus tested the vitamin proved to be soluble in water, absolute alcohol, acetone, and commercial ethyl acetate, but insoluble in ether, chloroform, and carbon tetrachlorid. Attempts to precipitate the vitamin by phosphotungstic acid from an alcoholic extract of lemon or orange juice led to the destruction of its activity, indicating that it is apparently nonnitrogenous. A purified extract was prepared from dried orange juice by successive extraction with absolute alcohol, acetone, ether, water, ethyl acetate, and water. The final extract protected guinea pigs from scurvy in doses equivalent to 20 cc. of the original juice, was strongly acid, slightly bitter in taste, reduced Benedict's solution, and contained much carbon but practically no nitrogen, mineral matter, lipoids, proteins, nor amino acids.

In attempts to obtain an active extract free from citric or other acids, it was found that on neutralizing lemon juice, first with powdered calcium carbonate and then with sodium carbonate until the solution was neutral to litmus paper, and adding absolute alcohol until precipitation of the salts was complete, the resulting extract, after evaporation of the alcohol, did not protect guinea pigs from scurvy, but that lemon juice neutralized with calcium carbonate or sodium bicarbonate was active even after standing. When orange juice was extracted successively with alcohol and acetone, neutralized, and the soluble portion dissolved in alcohol, the solution retained its antiscorbutic properties but did not produce normal growth. Similar results were obtained when ethyl acetate instead of alcohol was used for the final extraction.

The author is inclined to the opinion that certain solvents alter the chemical constitution of the antiscorbutic vitamin, which is assumed to be an active oxidizing agent.

Effects on guinea pigs of an antiscorbutic preparation, BEZSSONOFF (*Compt. Rend. Acad. Sci. [Paris]*, 175 (1922), No. 19, pp. 846-848).—The author has prepared an antiscorbutic extract from cabbage as follows: The juice is extracted from the cabbage with a hydraulic press and immediately clarified by treatment with neutral lead acetate. The solution is freed from lead by precipitation with hydrogen sulphid, evaporated in vacuo at a temperature of 35° C. to a sirupy consistency, and finally evaporated to dryness in vacuo at 35° in the presence of sulphuric acid. The resulting yellowish-white powder, 2.5 gm. of which corresponds to about 100 cc. of juice, is very hygroscopic and contains from 2.64 to 2.85 per cent of nitrogen, from 33 to 46 per cent of reducing sugars, from 52 to 65 per cent of total sugar, and about 7.5 per cent of ash. It contains no fat or protein and gives the characteristic blue color test previously noted (*E. S. R.*, 46, p. 668). In doses of 0.1 gm. it furnishes sufficient vitamin C for the normal development of guinea pigs of about 600 gm. weight.

In the course of experiments with this powder as the source of vitamin C, evidence was obtained that cod-liver oil in doses of 0.07 gm. or above daily appeared to have a harmful effect on guinea pigs, as suggested by Mouriquand and Michel (*E. S. R.*, 48, p. 760), but that this can be overcome by a larger dose of the antiscorbutic vitamin.

Studies on the therapeutic effect of *Bacillus acidophilus* milk and lactose, N. KOPELOFF and C. O. CHENEY (*Jour. Amer. Med. Assoc.*, 79 (1922), No. 8, pp. 609-611).—In this preliminary communication on the therapeutic value of *B. acidophilus* milk prepared by the method of Rettger and Cheplin (*E. S. R.*, 46, p. 870), the results are reported of its use for varying lengths of time on seven psychotic patients and seven normal controls. At the beginning of the treatment all of the patients were suffering from marked constipation and the controls from constipation or diarrhea. The usual daily administration was 1,000 cc. of the milk and 30 gm. of lactose, half of the amount being

taken between dinner and supper and the remainder between supper and bedtime.

Relief from the chronic constipation and diarrhea was secured in nearly every case. The bacteriological examination of the feces in a number of cases showed that there was a change in the intestinal flora, although the relative percentage of Gram-positive rods rarely exceeded 70 per cent.

In order to determine the keeping qualities of *B. acidophilus* milk, samples were kept at room temperature for two weeks and analyzed daily for acidity and for the number of viable *B. acidophilus* organisms. The milk was satisfactory for three or four days, after which there was a marked increase in acidity and a decrease in the number of viable organisms.

Metabolic disturbances in cats on a milk diet, G. W. PUCHER and K. F. CORI (*Jour. Biol. Chem.*, 54 (1922), No. 3, pp. 567-578).—In the course of studies conducted on cats to determine the effect of X-rays on metabolism, it was noted that the urine of cats fed meat and milk only was intensely alkaline to brilliant yellow paper, possessed strong reducing properties for Benedict's solution, and was of a disagreeable odor. Intermittent diarrhea was also noted. Qualitative observations on the changes in the urine accompanying a change in diet from meat and milk to meat and water indicated that the cause was the milk.

These observations were confirmed by quantitative experiments in which cats were kept in metabolism cages and fed for successive periods of several days each on 150 gm. raw meat plus water, 150 gm. raw meat plus 200 cc. of milk, 300 cc. of milk, 150 cc. of milk, and 150 gm. meat plus water. The urine was collected and determinations made of the volume, specific gravity, acidity, sugar, NaHCO_3 , NH_3 , and total nitrogen. The striking difference in the composition of the urine on the meat and water and milk diets is shown by the following figures, representing the average 24-hour excretion of a female cat on the meat and water diet and milk diet, respectively: Volume 109 and 187 cc., specific gravity 1.048 and 1.03, sugar 0 and 7.5 gm., acidity in terms of $\text{N}/10$ NaOH and $\text{N}/10$ H_2SO_4 , respectively, 50 and -52, NaHCO_3 0.018 and 1.16 gm., and NH_3 0.245 and 0.79 gm. Similar changes in the composition of the urine were observed as long as the animals were maintained on the milk diet, but the urine returned to normal value within 48 hours after the withdrawal of milk. While the mechanism of these changes in metabolism has not been determined, it has been shown not to be due to the lactose in the milk.

An outbreak of food poisoning by milk caused by *Bacillus aertrycke*, W. R. WISEMAN (*Brit. Med. Jour.*, No. 3225 (1922), pp. 728, 729).—An outbreak in Paisley, Scotland, of food infection traceable to *B. aertrycke* of the mutton and Newport types is reported and discussed briefly. The outbreak, which involved 52 cases but no fatalities, was traced to cow's milk from a single dairy.

ANIMAL PRODUCTION.

A preliminary statement of the results of Mr. Houwink's experiments concerning the origin of some domestic animals, J. P. LOTSY and K. KUIPER (*Genetica [The Hague]*, 4 (1922), No. 2, pp. 139-168, pls. 4).—A list of the experiments dealing with the origin of animals, which have been carried on for the past 25 years by R. Houwink of Meppel, Holland, is given. In the experiments crossings were made between different species and breeds of fowls, birds, ferrets, dogs, wolves, goats, cattle, pigs, horses, and some of the lower animals. The result of some of these experiments have been previously noted (*E. S. R.*, 45, p. 874; 47, p. 874). Experiments of A. von Tschermak¹ are also discussed

¹ *Biol. Zentbl.*, 37 (1917), No. 5, pp. 217-277.

in which crosses were made between Buff Cochins and White Minorcas, and Partridge Leghorns and Plymouth Rocks which gave different proportions of offspring showing certain characters in the reciprocal crosses. This was explained by the theory of the weakening of characters. Houwink, not agreeing with this theory, was led to carry out the experiments which are reported in this paper.

Since the experimental work of Houwink must now be discontinued, a report of the incomplete conclusions which it is now possible to draw in crosses between the Red Jungle Fowl (*Gallus gallus*) and the Silky fowls (*G. domesticus sericeus alba*) is presented. Varied results have been obtained relative to the characters of crest, leg feathering, pigment of the skin, silky plumage, etc., though in the Silky ♀ × Jungle ♂ crosses the F₁ birds were rose combed, whereas in two reciprocal crosses 11 rose combed and 14 single combed birds were produced. The authors conclude from the results of these experiments that no regular material or paternal dominance has occurred. This tends to disprove von Tschermak's theory.

The working up of the results of Kuhn's crosses at the Institute of Animal Breeding in the University of Halle, J. P. LOTSY (*Genetica [The Hague]*, 4 (1922), No. 1, pp. 32-61, fig. 1).—The composite results of a number of experiments in crossing different species of horses, cattle, sheep, swine, and dogs, started by J. Kuhn at the Institute of Animal Breeding at the University of Halle, are given. The purpose of these experiments was largely to make observations on the fertility of the hybrids between the different species, though the results of the behavior of some other characters are also given.

The cattle experiments included crosses between the domestic breeds and the yak, gayal (*Bibos frontalis*), gaur (*Bos gaurus*), banting (*B. sundaicus*), and zebu, and crosses between the zebu and banting. Fertile female hybrids resulted from all of these crosses, but the yak-cow hybrid males were sterile and the gayal-cow and gaur-cow hybrid males were partially fertile and partially sterile. No mature male hybrids were obtained in the other crosses. In the sheep experiments, Mufion sheep (*Ovis musimon*) and Persian wild sheep (*O. cycloceros*) were crossed with domestic sheep and the F₁ hybrids were all fertile. Species crosses in goats also proved fertile. Both male and female hybrids from crosses of Borneo wild swine (*Sus barbatus*) and European wild swine (*S. scrofa*) were fertile. Crossing wolves and jackals with domestic dogs produced fertile offsprings. In the horse breeding experiments, the Przewalsky horse and the domestic horse were crossed with the ass and the Przewalsky horse was crossed with the Mongolian horse. Fertile F₁ hybrids were obtained in the latter cross, but no offspring were obtained in the Przewalsky-ass cross, and the offspring obtained from the horse-ass cross were all sterile.

Very interesting results were also brought out with regard to the characters of the reciprocal crosses between the horse and the ass. It is usually understood that the hinny and the mule show different characteristics, whereas in these crosses it was determined that no hereditary differences existed.

Heredity, correlation, and regression, G. P. FRETS (*Genetica [The Hague]*, 3 (1921), No. 1, pp. 1-27, figs. 12).—Correlations between parents and offspring relative to cephalic index and stature in man are presented, and the relationship between regression and correlation was determined. Theoretically in populations where the variability in both contrasted characters is equal, regression and correlation coefficients should be the same.

The physiology of twinning, H. H. NEWMAN (*Chicago: Univ. Press, 1923*, pp. XII+230, figs. 71).—In contrast with the earlier book by this author on the biology of twins (*E. S. R.*, 88, p. 574), the present volume deals only with

twins from one egg, but is more extended in its scope in that it is not limited to mammalian twins but includes all known types of complete or partial one-egg twinning in the animal kingdom. A large part of the book is based on the theory, previously advanced for quadruplets in the armadillo, "that the process of twinning was due to a lowering of the rate of metabolism of the early embryonic vesicle, resulting in the physiological isolation of parts at certain distances from the dominant (apical) region."

Supplementary notes on twins in cattle, F. R. LILLIE (*Biol. Bul. Mar. Biol. Lab. Woods Hole*, 44 (1923), No. 2, pp. 47-78, figs. 13).—Further work on the cause of freemartins has been carried on, the results of which have mainly substantiated practically all the conclusions previously noted on this subject (E. S. R., 40, p. 466). Forty more pairs of twins have been examined, and the conditions found in each case have been tabulated. The results of related work which has been recently reported by other investigators are also briefly summarized and discussed.

The chromosome content of organisms, J. P. LOTSY (*Genetica [The Hague]*, 4 (1922), No. 1, pp. 1-22, fig. 1).—The chromosome numbers of different plants, animals, and insects which have been published are given, followed by a discussion of the occurrence of X and Y or of only X- or Y-chromosomes in certain organisms. The author suggests that the occurrence of the single chromosome may be evidence of the part played by hybridization in the evolution of the plant or animal in question.

Studies on the mechanism of sterilization of the female by spermatoxin, J. L. MCCARTNEY (*Amer. Jour. Physiol.*, 63 (1923), No. 2, pp. 207-217).—In studies in the physiological laboratory at the University of Chicago it was found that female rats were rendered sterile for from 2 to 22 weeks by subcutaneous injections of spermatocidal fluid or extracts of testes, though no interference with the sexual cycle occurred. Similar results were obtained with poultry in that the eggs produced were mostly infertile for from 12 to 67 days after injection.

From agglutination tests it was determined that the sterility was due to the presence of spermatocidal toxins in the vaginal and uterine secretions which agglutinated the spermatozoa. Subcutaneous injections of spermatozoa from rats and man into male rats caused a temporary destruction of motility of the sperms and atrophy of the testes, which in some cases remained permanent.

On the function of the corpus luteum and the physiological correlation between the ovary and the uterus, F. NIELSEN (*K. Vet. og Landbohøjsk. [Copenhagen]*, Aarskr. 1921, pp. 297-336, figs. 5).—Experiments have been carried on, mostly with rabbits, to determine the function of the corpus luteum. It was found when the corpus luteum was removed from 4 to 21 days after ovulation, whether the animals were pregnant or not, ovulation followed in 1 or 2 days. Cutting uterine segments longitudinally was found to result in three distinct structural changes, depending on the time elapsing after ovulation, which thus was an indication of the age and the activity of the corpus luteum.

It was concluded that the presence of the corpus luteum seems to be essential for the formation of artificial placentas, and it is therefore thought this tends to substantiate the theory that the corpus luteum is necessary for the fixation and development of the fertilized egg.

A discussion is given of the relationship of the corpus luteum to oestrus, and it is concluded that the evidence furnishes additional proof that the corpus luteum is the cause of menstruation. An English abstract accompanies the article.

Contribution to the determination of sex, M. BOLAFFIO (*Riv. Biol.*, 4 (1922), No. 2, pp. 145-169, pl. 1, figs. 3).—Observations on 207 births in the clinical hospital in Rome showed that the sex of the children born was apparently partially dependent on the relationship of the time of fertilization of the ovum to the menstrual period. When fertilization occurred from 5 days before to 2 days after menstruation 90 per cent of the children were female, but about 75 per cent of the children resulting from fertilization between the third and twelfth day after menstruation were males. Thus it may be stated that ova fertilized when fresh are more liable to produce females, while late fertilized ova more often develop into males.

In endeavoring to explain this occurrence frequent references are made to other works on this subject dealing with the cause of sex as related to the chromosome number. It is concluded that the male or female is equally liable to be heterozygous, and that the homozygous condition of the chromosomes in either sex is relatively rare, though when it does occur the male is the more frequent one that is homozygous. The chromosome content of both sexes is thus usually $2n+x$. Two types of gametes are then formed by both sexes during maturation, n and $n+x$. Four types of zygotes may result by fertilization, but the $2n$ and the $2n+2x$ zygotes are weak and usually perish. The sex of the $2n+x$ zygotes is determined as opposite to that from which the X-chromosome came.

It is assumed that the stage of maturity of the egg cell may in some way affect the contents of the polar body given off so that when it is excluded early it contains the X-chromosome, but when given off late the X-chromosome stays with the ovum. A discussion is also given showing how this calculation may be applied to cases of twins of the same or different sexes and to pseudo-hermaphroditism.

The male tortoiseshell cat, R. C. BAMBER (BISBEE) (*Jour. Genetics*, 12 (1922), No. 2, pp. 209-216).—In continuing work started by I. C. Doncaster, 70 pregnant cats have been killed and the chorions of the 253 developing kittens were examined for any confluence of the blood vessels, in support of the theory previously advocated by Doncaster that the cause of sterility of the tortoiseshell tomcat is similar to the case of the freemartin. No definite cases of confluence of the blood vessels were observed, however, though two doubtful cases of fusion of chorions were found. It is suggested that factors for modifying sex may be present similar to those reported in pigeons by Riddle (*E. S. R.*, 35, p. 771) and in moths by Goldsmith. The tortoise-shell male may be a male with a very slight female tendency or a female with a marked male tendency.

Studies of the thyroid apparatus.—IX, The effects of the loss of the thyroid and parathyroid glands at 100 days of age on the growth in body length, body weight, and tail length of male and female albino rats, F. S. HAMMETT (*Amer. Jour. Physiol.*, 63 (1923), No. 2, pp. 218-244, figs. 7).—In studying the effect of the thyroid and parathyroid glands on growth in rats at the Wistar Institute, 12 males and 13 females had their thyroid and parathyroid glands totally removed at 100 days of age, and 14 other males and 15 females had only their parathyroid glands removed at the same age. Weekly records were kept for 50 days on these rats as to the increase in body and tail length and body weight. These growth records were compared with the records of 11 male and 11 female controls, which were litter mates of the experimental rats.

Considering the growth of the control rats during the 50 days as 100, the relative growths for male and female rats having their thyroid glands removed were, respectively, for body length 47.2 and 84.5, for tail length 37.2 and 19.4,

and for body weight 31 and 28.2. The relative growths for the rats having only their parathyroid glands removed were, respectively, 64 and 47.2, 63.9 and 49.3, and 57.1 and 20.7. The effect of the removal of the parathyroid and thyroid glands on growth was found to be practically the same in both sexes, except that in the female a greater reduction in growth rate seemed to occur.

Assuming that increases in body weight were due to an increase in cell size, whereas increases in body length and tail length were due to an increase in cell number, it was noted that the removal of the glands apparently caused a greater disturbance in the growth due to cell size than in growth by cell division. The growth in parathyroidectomized rats was irregular, but was greater than in rats in which both the thyroid and parathyroid glands had been removed. It was concluded that the growth retardation resulting from parathyroidectomy was due to an accumulation of toxins which are eliminated irregularly, but in the thyroidectomized rats the stimulus to grow was in a measure lacking.

Carrying out and calculating metabolism experiments with ruminants, A. C. ANDERSEN (*K. Vet. og Landbohøjsk. [Copenhagen], Aarskr. 1920, pp. 157-179*).—This is a description of a method of calculating heat production, based on the respiratory metabolism in ruminants. The amount of protein broken down is calculated from the amount of nitrogen excreted in the form of urea. From this the amount of carbon dioxide in the protein is calculated as well as the amount of oxygen for combustion. Any additional carbon dioxide production or oxygen consumption, as determined in the respiratory chamber, would be due to or be used for combustion of nitrogen-free material. The combustion of one volume of methane requires one volume of oxygen and produces one volume of CO₂. The total heat production is then calculated from the total oxygen consumption and CO₂ production by the formula

$$\text{Heat production} = \text{Of} [4.686 + 1.23(R - 0.707)],$$

in which Of represents the oxygen consumption in liters and R is the respiratory quotient. The heat value of the fat and the methane formed are subtracted from the result, and the heat value of the protein broken down is added to it for the determination of the net energy exchange in calories.

Investigations of the feeding value of straw hydrolyzed by various processes.—V. Cold treatment of straw with caustic soda and caustic lime (Beckmann process), F. HONCAMP and E. POMMER (*Landw. Vers. Sta., 99 (1922), No. 4-5, pp. 231-266, figs. 2*).—In continuing the studies of the feeding value of hydrolyzed straw (*E. S. R., 48, p. 265*), digestion trials were carried on with 3 wethers similar to the previous trials to determine the digestibility and nutrients in oat and pea straw treated with caustic soda and in oat straw treated with caustic lime for periods of 24, 36, and 72 hours without pressure or heat. The basal ration fed to the wethers in addition to the straw consisted of 250 gm. of meadow hay and 125 gm. of palm kernel meal daily. The amount of straw added to this ration was as follows in the different trials: 400 gm. of untreated pea straw, 1,000 gm. of treated pea straw, 200 gm. of untreated oat straw, 1,500 gm. of oat straw treated with NaOH, or 1,200 gm. of oat straw treated with CaO.

The caustic soda treatment consisted of adding a 2 per cent solution to the chopped straw which was then allowed to stand for 12 hours. For the caustic lime treatment 25 kg. of chopped straw were mixed with 2,500 liters of water and 2.5 kg. of caustic lime. This mixture was allowed to stand 24, 36, or 72 hours. The 24-hour treatment, however, was found to give practically the same

results as the longer treatments. The excess alkali in the material after treatment was removed by washing.

As in the previous work, hydrolysis resulted in a destruction of considerable organic matter, both by the action of the chemicals and by washing out the soluble materials, but increases in the digestibility of the fiber and nitrogen-free extract occurred which gave the treated straw a much higher feeding value. The starch value of 100 kg. of pea straw was 4.4 kg., but when treated with sodium hydroxid the starch value of a similar amount of straw was increased to 17.8. One hundred kg. of untreated oat straw had a starch value of 20.6, whereas a similar amount treated with sodium hydroxid showed a starch value of 40.6, and when treated with caustic lime for 24 hours the starch value was 41.6 kg.

The authors concluded that the cold treatment of straw with caustic soda increased the feeding value to about the same extent as similar treatments under pressure. The losses of nutrients by this method were slightly greater than when straw treated under pressure with a weak solution was not washed, but the losses were less than with the pressure treatment followed by subsequent washing. The caustic lime treatments were carried on at a temperature of about 0° C., and practically the same results were obtained as with the caustic soda treatment, except that a greater percentage of the nitrogen-free extract was retained in the product by the lime treatment.

Production and feeding value of hydrolyzed straw, O. ENGELS (*Landw. Jahrb. Bayern, 10 (1920), No. 3-4, pp. 87-110*).—This is a discussion of the different methods which have been used for hydrolyzing straw, with reference to the costs of treatment and the relative losses in organic matter and increases in digestibility which have occurred.

Factors affecting range management, J. L. LANTOW (*N. Mex. Agr. Col. Bot. Circ. 74 (1922), pp. 14, figs. 6*).—This is mainly a summary of 60 replies to a questionnaire sent to 247 ranchmen of New Mexico relative to the best practices of range management.

The composite opinions indicated that supplemental winter feeding of the cows produce 24 per cent more calves, which average 11 lbs. heavier in weight than calves from cows not receiving supplemental feeding. Two-year-old heifers were estimated as giving a 79 per cent calf crop as 3-year-olds when fed supplementary feeds during both years, but when not fed the supplementary ration a calf crop of 18 per cent was estimated for 3-year-olds which had already produced calves as 2-year-olds. Nearly all farmers reporting were more favorable to breeding helpers to calve at 3 years of age than at 2 years, though the average age at which the helpers calved on the farms from which reports came was 2 years and 4½ months.

Ninety per cent of the farmers favored bull control, and some others favored it but thought the practice was impracticable.

Plan forages, H. W. MUMFORD (*Swine World, 10 (1923), No. 14, p. 13*).—A forage crop table is presented for swine which shows the amount of seed which should be sown, the length of the grazing period, and the number of days from planting to grazing time so that an almost complete rotation of forage crops may be maintained.

The effect of change of temperature on the basal metabolism of swine, J. W. CAPSTICK and T. B. WOOD (*Jour. Agr. Sci. [England], 12 (1922), No. 3, pp. 257-268, pl. 1, figs. 3*).—The relation of basal metabolism to the environmental temperature has been studied from the results of the metabolism experiment with a barrow previously noted (*E. S. R., 48, p. 475*) as a basis.

It was shown that as the environmental temperature decreased below the critical temperature, which was determined at 21° C. (69.8° F.) in this experiment, the metabolism of the pig increased at the rate of approximately 4 per cent per degree. The basal metabolism of a 300-lb. hog, expressed in calories per minute at different temperatures after correcting to an age of 420 days, was determined from the data obtained as follows: At 10.3°, 2.166; at 12.8°, 1.943; at 13.3°, 1.9; at 13.6°, 1.876; at 16.9°, 1.767; at 20.4°, 1.503; and at 23.7°, 1.490 calories.

Attention was called to the practical application of these results to the maintenance requirements of farm animals. It was noted that a difference in the environmental temperature might be a possible explanation of the differences in the maintenance requirements of animals as determined by European and American investigators.

On the use of artificial insemination for zootechnical purposes in Russia. E. I. IVANOFF (*Jour. Agr. Sci. [England]*, 12 (1922), No. 3, pp. 244-256).—This is an account of the practice of artificial insemination from 1909 to 1913 in the horse-breeding operations in Russia with reference to the establishment of government stations for horse breeding. There is a great lack of suitable males for breeding purposes in Russia, but by methods of artificial insemination one stallion may fertilize upwards of 300 mares in a season. The percentage of conceptions has also been increased. The results on five different stallions showed that an average of 43.4 per cent of the mares which they served conceived, but 84.6 per cent of the mares artificially inseminated with spermatozoa from these stallions conceived. The difficulties of distance from stallion, diseases of the mares, mechanical obstacles in the way of breeding, etc., are largely overcome by this method, and by having the stallions properly distributed in government stations it is possible to reach a large number of horse breeders.

How to raise the chicks. G. S. VICKERS and D. C. KENNARD (*Ohio Agr. Col. Ext. Bul.*, 18 (1922-23), No. 8, pp. 4, fig. 1).—This consists of practical directions on handling chicks in the brooder and methods of feeding young chicks.

DAIRY FARMING—DAIRYING.

The effect of the age of sire and dam on the quality of offspring in dairy cows, C. L. ALLEN (*Jour. Heredity*, 13 (1922), No. 4, pp. 167-176, figs. 7; also in *Holstein-Friesian World*, 20 (1923), No. 17, pp. 817-819, 832, figs. 5).—To study the influence of the age of the parents on the production of the offspring, a study was made of all (611) 7-day fat records over 24 lbs., and all (510) under 14 lbs. of mature cows recorded in volume 27 of the Holstein-Friesian Advanced Registry Yearbook.

The high and low producers were each divided into three groups according to production, and pedigrees were compiled for each of the animals, showing the parents, grandparents, and great grandparents, and the date of birth of each. The average age of the ancestors at the time of birth of the animal in question in the high and low producing selections were, respectively, sires 47.1±0.647 and 43.1±0.529, dams 61.±0.89 and 63.1±0.941, paternal grandsires 49.5±0.717 and 46.6±0.646, paternal grandams 66.7±0.929 and 66.7±1.034, maternal grandsires 42.1±0.507 and 43.6±0.508, and maternal grandams 61±0.873 and 64.7±1.013 months. Greater differences were observed in the age of parents in the three subdivisions of each group than between the averages of the two groups. Classifying the cows making the records according to the age of the sire and dam at the time of their birth also showed no advantage for old or young parents as to their power to produce superior offspring.

A study of 506 A. R. O. daughters of 4 bulls showed that bulls are likely to get as good daughters at a young age as when they are more mature. The higher producing cows in the study were found to make their best records at an average age of 72.2 months, indicating that this is the time of maximum production.

The relation between age and production of Holstein-Friesian cows, C. W. TURNER (*Holstein-Friesian World*, 20 (1923), No. 12, p. 557).—The yearly Advanced Registry fat records of 13,599 Guernseys, 13,823 Jerseys, and 10,375 Holsteins have been tabulated and averaged according to age. The highest average maximum production was made by Guernseys between 7 and 8 years of age, Jerseys between 8 and 9 years, and Holsteins from 6 to 7 years of age, with gradual decreases in production for younger and older animals.

Effect of delayed breeding on milk production, C. H. ECKLES (*Hoard's Dairyman*, 65 (1923), No. 7, pp. 230, 263, fig. 1).—A study of the effect of delayed breeding on cows in the University of Minnesota herd is briefly reported. Nineteen cows which were in milk an average of 305 days produced 6,508 lbs. of milk, whereas the same cows in years when they had been in milk an average of 579 days produced 10,032 lbs., or 7,650 lbs. of milk in 365 days. The 365-day fat yields were 298 and 349 lbs., respectively. The cause of the decline in milk flow of pregnant cows is attributed to secretions of the fetus.

The effect of pregnancy on growth and milk production, C. W. TURNER (*Breeder's Gaz.*, 83 (1923), No. 12, p. 395).—The results of studies of Guernsey advanced registry records at the Missouri Experiment Station have shown that the milk yield of cows that have been pregnant 150 days shows some reduction, but after 200 days of pregnancy there is a distinct dropping off in milk yield. Based on records kept of the helpers raised, the normal monthly weights and heights to 12 months and at 6-month intervals to 30 months of age are given for Holstein and Jersey helpers. A table showing the average fat percentage of Guernsey, Jersey, and Holstein milk during the different months of lactation shows that there is a decline from the first to the second or third month, followed by a gradual increase in percentage which is more pronounced toward the end of lactation.

Studies of variation in domestic animals, E. FEIGE (*Fühling's Landw. Ztg.*, 70 (1921), No. 17-18, pp. 335-348, figs. 3).—This is a study of the variability in body measurements and fat percentage of milk produced by cows in the milk testing association of East Prussia. A more uniform curve of variability was found to result in the case of the fat content than in the case of the measurements of any of the body characters. The first study of this series was previously noted (*E. S. R.*, 48, p. 165).

Biometrical and hereditary studies of the escutcheons of cows, J. BRUN (*Jahrb. Wiss. u. Prakt. Tierzucht*, 15 (1922), pp. 72-124, figs. 4).—This paper deals with the method of inheritance of escutcheons of different shapes and a biometrical study of their relation to certain body measurements and milk production. The first part of the article consists of a review of previous work on the relation of the escutcheon to milk and fat production, going back to the time of Guénon, the founder of this idea. This review is followed by the report of a biometrical study on 175 Brown Swiss and 130 Simmentaler cows. The means, standard deviations, and coefficients of variability were determined for 20 body measurements of the cows, made mostly in the region of the pelvis and udder. The escutcheon of the cows were also measured and classified according to shape, and the milk production of the Brown Swiss cows was determined. The correlation coefficients between various of the body characters and the escutcheon characters were also calculated.

The more significant correlations obtained for the Swiss and Simmentaler cattle, respectively, between height of escutcheon and the following characters were distance from pin bone to front of udder 0.59 ± 0.063 and 0.40 ± 0.104 , length of udder 0.40 ± 0.081 and 0.36 ± 0.107 , breadth of udder 0.46 ± 0.076 and 0.34 ± 0.109 , and depth of udder 0.51 ± 0.071 and 0.48 ± 0.094 . The correlations between the circumference of the udder and the height of escutcheon, however, were much less, 0.11 ± 0.095 and 0.07 ± 0.123 , respectively. The correlation coefficients between the distance from the pin bones to the fore part of the udder and the length, breadth, and depth of the udder and the milk production, varied from 0.73 ± 0.047 to 0.93 ± 0.013 , whereas the correlation between the height of the escutcheon and the milk yield was 0.605 ± 0.004 . The cows having lyre-shaped escutcheons were found to show correlations between milk production and height of escutcheon of 0.86 ± 0.052 , as compared with coefficients of only 0.36 ± 0.103 for the cows having gable-shaped escutcheons.

The author's conclusions are very similar to those of Donnet, reported in an inaugural dissertation, i. e., the escutcheon may serve as an indication of milk production, not because it is a positive sign as Guénon thought but because it is largely controlled by other characters which determine production. In determining the frequency of different shaped escutcheons, it was found that 71 per cent of the Brown Swiss and 58 per cent of the Simmentaler cows had escutcheons of the gable shape, while 24 and 22 per cent, respectively, had escutcheons of the lyre shape. The rest of the cows had other less common shaped escutcheons.

In studying the method of inheritance of the different shapes of escutcheons, observations on the offspring of Brown Swiss cows in the P, F₁, and F₂ generations showed that about four-fifths of the offspring had the same escutcheon shape as their dams, but in the Simmentaler cows in the three generations less uniformity occurred between dams and offspring. The author states that the results indicate a method of inheritance in which the escutcheon shape of the dam is usually dominant, while the sire may be neglected in considering this character. The exceptions to this rule were explained as due to incomplete dominance, lack of purity of the animals, or possibly some effect from the sire.

The cull cow and its disposal, A. R. YOUNG (*New Zeal. Jour. Agr.*, 26 (1923), No. 1, pp. 11-15).—This is a discussion of the methods of improving dairy herds, with special reference to the disposal of cull animals so that they will not again be sold for breeding purposes.

Dairy farming, R. T. ARCHER (*Jour. Dept. Agr. Victoria*, 20 (1922), Nos. 11, pp. 641-656, figs. 6; 12, pp. 705-721, figs. 5).—This is a general article on dairy farming discussing the principles of feeding, care, and management of cows and calves; method of milk secretion; and care and cleaning of milking machines, milk strainers, and separators. Tables showing the digestibility nutrients and comparative value per ton of the more common feeding stuffs for dairy cattle are given.

Dairy cattle feeding experiments, G. B. ROTHWELL (*Canada Expt. Farms, Anim. Husb. Div. Interim Rpt.*, 1921, pp. 7-15).—The following feeding experiments carried on with dairy cattle during the year ended March 31, 1921, are briefly noted:

Most profitable amount of grain to feed (pp. 7-11).—Three feeding tests consisting of three periods each were carried on with 16 dairy cows. All of the cows received daily 30 lbs. of silage, 10 lbs. of turnips, and 6 lbs. of hay, and during the first and third periods of each test 1 lb. of a grain mixture for each

3 lbs. of milk produced. This grain mixture consisted of 400 lbs. of bran, 200 lbs. of gluten feed, 200 lbs. of dried distillers' grains, and 100 lbs. of linseed cake. In the second period of the first, second, and third tests 1 lb. of grain was fed per 2, 4, and 5 lbs. of milk produced, respectively. The milk and fat production during the third week of the first and third periods were compared in each test with the production during the third week of the second period.

In the first experiment an average of 23.13 lbs. of milk and 0.94 lb. of fat were produced per day during the first and third periods, whereas in the second period 25.97 lbs. of milk and 1.08 lbs. of fat were produced on the 1 lb. of grain to 2 lbs. of milk ration. The daily milk production in the period when 1 lb. of grain was fed to 4 lbs. of milk produced was 19.96 lbs. and in the comparative 1:3 period 19.4 lbs. The respective daily fat productions were 0.78 and 0.75 lb. In the third experiment 22.46 lbs. of milk and 0.82 lb. of fat were produced daily in the first and third periods, but when the ration was decreased to 1 lb. of grain to 5 lbs. of milk 21.13 lbs. of milk and 0.77 lb. of fat were produced.

The feed cost per 100 lbs. of milk was lowest where the lighter rations were fed. In determining the relative amount of grain to feed according to the milk production it is necessary to take a number of factors into consideration, the condition of the cows, stage of lactation, average production of cows, quality of grain mixture, costs of feed, and the roughage that is being fed.

Ready mixed v. home mixed v. commercial feeds (pp. 12-14).—During the first, third, and fifth 3-week periods of an experiment 1 lb. of a home-grown mixed grain ration consisting of 500 lbs. of wheat, 200 lbs. of oil-cake meal, 100 lbs. of distillers' dried grains, 100 lbs. of cottonseed meal, and 100 lbs. of palm-nut cake meal was fed to 12 dairy cows for each 3.5 lbs. of milk produced. During the second period Ontario Standard meal mixture replaced the above grain and in period 4 Schumacher feed replaced the bran of the grain mixture fed in periods 1, 3, and 5. The average daily milk production during the respective periods, Nos. 1 to 5 was 26.8, 25.1, 20.3, 19.75, and 20.77 lbs. The respective amounts of grain consumed per 100 lbs. of milk produced were 35.8, 30.7, 33.2, 25.7, and 28.3 lbs. It was necessary to change the silage during period 4, which may have affected the results at that time. Though the Ontario Standard meal mixture produced slightly more milk, it was also more expensive.

Trial of "zool" (pp. 14, 15).—"Zool" was fed to 2 calves during a period of 5 weeks without any particular advantage being shown for it as a condimental feed. Chemical analyses indicated that the feed should be valuable chiefly because of its phosphoric acid content.

Soiling crops keep up milk flow in summer, C. W. TURNER (*Jersey Bul. and Dairy World*, 42 (1923), No. 12, pp. 553, 592).—Soiling crops are advocated to supplement pasture for dairy cattle and keep up the milk flow during July and August. A table giving a suggested succession of soiling crops for dairy cows is given.

Winter feeding of dairy cows, R. B. TENNENT (*New Zeal. Jour. Agr.*, 26 (1923), No. 1, pp. 29-33, figs. 2).—To compare oat-and-pea silage with turnips and oat straw for milk production, 10 cows were selected and fed during 5 feeding periods of 9 and 10 days each on the following average daily rations: Period 1, 131 lbs. of turnips and 13 lbs. of oat straw; period 2, 50 lbs. of silage and 18 lbs. of oat straw; period 3, 50 lbs. of silage, 20 lbs. of turnips, and 13 lbs. of oat straw; period 4, 131 lbs. of turnips, 6 lbs. of alfalfa hay, and 6 lbs. of red clover hay; and period 5, 40 lbs. of silage, 60 lbs. of turnips, 6 lbs. of alfalfa hay, and 6 lbs. of clover hay. The average daily milk yields during

the last 4 days of each period were, respectively, 169, 146, 145, 164, and 100 lbs.

The author concludes that "oat-and-pea silage does not compare very favorably with turnips for milk production. On a comparative basis 2 lbs. of turnips are equal to approximately 1 lb. of silage."

Handbook of dairying on a scientific and practical basis, W. KIRCHNER (*Handbuch der Milchwirtschaft auf Wissenschaftlicher und Praktischer Grundlage*. Berlin: Paul Parey, 1922, 7. ed., rev., pp. VIII+579, figs. 45).—This book, which was published after the death of the author, was partially revised from earlier editions before his death, and the balance of the work was done by W. Grimmer. It deals with the properties, production, handling, and methods of determining adulteration in milk, cream, butter, and cheese. Chapters on the food value of fresh, powdered, and condensed milk, and the cost of producing milk are also included.

How to produce clean milk, J. MACKINTOSH (*Jour. Min. Agr. [London]*, 29 (1922), No. 1, pp. 17-29).—The factors to be considered in the production of clean milk consist of clean and healthy animals and milkers, clean utensils, small top pails, thorough cooling, and holding the milk to 50° F. or below immediately after milking.

A guide for formulating a milk ordinance, T. H. BROUGHTON and E. J. FRIAR (*Milk Dealer*, 12 (1923), No. 6, pp. 26, 28, 30, 32).—A sample ordinance for the regulation and control of the sale of milk and milk products is given which might be filled out and adopted by any city.

Value of the bacterial count in scoring ice cream, B. W. HAMMER (*Creamery and Milk Plant Mo.*, 12 (1923), No. 3, pp. 76, 78, 80).—The value of bacterial counts of ice cream lies in its indication of the manner and conditions under which the ice cream was produced. No determinations could satisfactorily be made of the pathogenic bacteria which it contains, but high bacterial counts, especially of certain types of organisms, are indicative of a lack of care in production which may allow for the entrance of disease-producing organisms.

VETERINARY MEDICINE.

The animal parasites of man and the domestic animals, C. P. SLUITER, N. H. SWELLENGREBEL, and J. E. W. IHLE (*De Dierlijke Parasieten van den Mensch en van Onze Huisdieren*. Amsterdam: Scheltema & Holkema's Boekhandel [1921], 3d. ed., rev. and enl., pp. IX+574, pl. 1, figs. 282).—This work, the second edition of which was issued in 1912, deals with the subject as follows: Protozoa (pp. 13-158); Scolecida, including the platyhelminths, nematodes, and acanthocephalans (pp. 159-455); Annulata, including the leeches (pp. 455-470); and Arthropoda, including arachnids and insects (pp. 470-558).

Report of the Montana Live Stock Sanitary Board and State veterinary surgeon, including report of chemist, and bacteriologist and pathologist, and summary of work for years 1921-1922, W. J. BUTLER, E. STARZ, and H. MARSH (*Mont. Live Stock Sanit. Bd., [Bien.] Rpt. 1921-22*, pp. 24).—This report covering the years 1921 and 1922 includes accounts of the occurrence of and work with infectious diseases of live stock in the State. Investigations by Marsh, the pathologist and bacteriologist of the board, led to the conclusion that the progressive pneumonia of sheep is infectious, two organisms having been isolated quite constantly from the lungs of affected animals.

Biennial report of the State veterinarian of the State of Wyoming for the period October 1, 1920, to September 30, 1922, B. F. DAVIS (*Wyo. State Vet. Bion. Rpt., 1920-22*, pp. 56, fig. 1).—This includes a discussion of work with infectious diseases of live stock.

Annual report of the Civil Veterinary Department, Bihar and Orissa, for the year 1921-22, P. B. RILEY (*Bihar and Orissa Civ. Vet. Dept. Ann. Rpt.*, 1921-22, pp. [3]+8+XIV+2, pl. 1).—This is the usual annual report (E. S. R., 46, p. 480).

Combating of animal diseases, S. YOUNGBERG ET AL. (*Philippine Bur. Agr. Ann. Rpt.*, 20 (1920), pp. 27-34, pls. 6).—This is a brief report upon control work with infectious diseases of live stock, particularly with rinderpest.

During the year 1920, 22,442 new cases of rinderpest and 16,911 deaths were recorded, indicating a decided increase over the previous year. A total of 5,444 liters of antirinderpest serum was used during the year. In immunization operations, 9,805 animals were immunized by simultaneous inoculation.

Note on helminths common to man and domesticated animals, R. DAUBNEY (*Vet. Jour.*, 79 (1923), No. 573, pp. 85-99).—A brief summary of information on the subject.

Anthrax infection and antianthrax immunity in rabbits and guinea pigs, L. BALTEANO (*Ann. Inst. Pasteur*, 36 (1922), No. 11, pp. 805-811).—The author has repeated the experiments of Besredka (E. S. R., 44, p. 877) on the immunization of guinea pigs and rabbits against anthrax. He confirms his conclusions that in these animals the skin is the only organ sensitive to anthrax infection, and that by cutaneous vaccination the animal can be rendered immune against anthrax virus whatever its point of inoculation.

The value of normal beef serum in anthrax infection, H. ZEHETMAYR (*Centbl. Bakt. [etc.]*, 1. Abt., Orig., 89 (1922), No. 6, pp. 153-161).—Evidence is presented in a series of inoculation experiments conducted on guinea pigs that treatment of experimental anthrax with normal beef serum, as recommended by Kraus (E. S. R., 45, p. 683), is successful only when the serum is injected in the same place as the virus, the favorable effect apparently being due to some local antagonistic action. It is concluded that normal instead of immune serum is of value in the case of local but not of generalized anthrax.

On a soluble toxin produced by *Bacillus chauvæi*, K. OKUDA (*Jour. Japan. Soc. Vet. Sci.*, 1 (1922), No. 3, pp. 157-199).—The production of a soluble toxin by *B. chauvæi* has been demonstrated as follows:

In a medium of broth with from 10 to 20 per cent of fresh blood, *B. chauvæi* grew rapidly under aerobic conditions. The culture as thus grown was found to be virulent for guinea pigs and rabbits. The filtrate from the culture was fatal to guinea pigs when injected intravenously in 0.5-cc. doses or subcutaneously in doses of from 3 to 5 cc. On the addition to the blood-broth medium of 0.5 cc. of anhydrous sodium sulphite, the toxin production was increased to such an extent that 0.1 cc. of the filtrate proved fatal for guinea pigs. The toxin production in the blood broth reached its maximum in from 2 to 4 days when incubated at 37° C., the toxicity then diminishing gradually until at 17 days the culture was usually too feeble to cause death.

The animals which survived the intravenous injection of the toxin proved to be immune to the virus when injected subcutaneously 2 or 3 weeks later. Mice proved immune to the toxin and rabbits showed a temporary rise in temperature, but no marked symptoms otherwise.

Vaccination against blackleg with toxins, E. LECLAINCHE and H. VALLÉE (*Compt. Rend. Acad. Sci. [Paris]*, 176 (1923), No. 4, pp. 207-210).—Attention is called to the observation that *Bacillus chauvæi*, when grown in a suitable medium such as Martin's bouillon, secretes within 24 hours a virulent toxin, but that the initial toxicity disappears more or less rapidly. As the culture ages with spontaneous lysis of the microbial bodies following sporulation, the medium acquires a toxicity of a new form which manifests itself by the pro-

duction of toxins of a more local action. On the theory that for successful immunization against this organism recourse should be had to both forms of toxin, the author suggests the use as an immunizing agent of a filtrate prepared from a 24- to 48-hour culture of *B. chauvæi* mixed with the endotoxin obtained from a 3- to 5-days' culture. A description is given of the technique of the method of preparing this combined filtrate.

Investigations on the question of reciprocal immunity against cowpox and foot-and-mouth disease in cattle and guinea pigs, P. UHLENHUTH and W. BIEBER (*Ztschr. Immunitätsf. u. Expt. Ther.*, I, *Orig.*, 35 (1922), No. 4, pp. 311-329).—Cattle and guinea pigs vaccinated against cowpox were found to be no more resistant to foot-and-mouth disease than unvaccinated animals. This is thought to refute the statement of certain workers that cattle vaccinated against cowpox are not susceptible to foot-and-mouth disease.

Technique and results of blood investigations in dourine, H. DAHMEN (*Deut. Tierärztl. Wchnschr.*, 31 (1923), No. 7, pp. 75-79).—This is a summary of the author's investigations on the serum diagnosis of dourine previously noted (*E. S. R.*, 46, p. 774.)

Specific serum treatment for so-called joint-ill, SCHMIDT (*Berlin. Tierärztl. Wchnschr.*, 38 (1922), No. 42, pp. 481, 482).—A brief report is given of the author's experience in the prophylactic treatment of foals for joint-ill.

On the theory that many foals succumb in the first few days of their life to infection with *Bacillus coli* or *B. viscosum*, 18 foals were vaccinated subcutaneously within an hour after birth with 50 cc. of a commercial serum against these two organisms. Two foals showed a slight reaction, one on the second and one on the third day. The rectal temperature varied between 38.8 and 39° C. and in one case there was slight diarrhea. This animal received a second injection of the serum, which checked the diarrhea in 3 days. The temperature in all cases became normal in about 2 days and there was no evidence of lameness or swelling of the joints.

Another foal which showed, 8 hours after birth, a rapid pulse and a temperature of 39°, was given 50 cc. of the serum intravenously. Twenty-four hours later the temperature had fallen to 38.6°, and the animal soon made a complete recovery. In two cases of severe joint-ill in animals 2 and 4 days old, similar intravenous injections had no effect, the animals dying within a few hours.

It is also reported that three intravenous injections of 50 cc. of a streptococcus serum cured a 3 weeks' old foal suffering from the streptococcus form of joint-ill.

On the comparative study of Nocard's bacillus with Grawitz's acne bacillus, K. TSUGE (*Jour. Japan. Soc. Vet. Sci.*, 1 (1922), No. 4, pp. 213-233).—The author's studies, which include fermentation and serological tests with the bacilli and immunity experiments with the toxins, indicate that the acne toxin and the toxin of Nocard's bacillus are the same.

The action of Bayer 205 on trypanosomes, piroplasms, theilerias, and anaplasms, E. BRUMPT and G. LAVIER (*Bul. Soc. Path. Exot.*, 15 (1922), No. 7, pp. 613-621, fig. 1; *abs. in Trop. Vet. Bul.*, 10 (1922), No. 4, pp. 111, 112).—This is a summary of the literature on the subject, together with a report of personal observations. A bibliography of 19 titles is included.

Trypanosoma cruzi (Chagas, 1909) in laboratory animals, in the redivid (*Rhodnius prolixus*), and in the bedbug (*Cimex lectularius*), A. ROBERTSON and M. J. TRIFFITT (*Vet. Jour.*, 79 (1923), No. 572, pp. 49, 50).—This is a brief summary of the author's observations.

The complement deviation reaction in the diagnosis of tuberculosis in domestic animals, L. PANISSET and J. VERGE (*Ann. Inst. Pasteur*, 36 (1922),

No. 10, pp. 690-719).—This is a more detailed report of an investigation which has been essentially noted from another source (E. S. R., 47, p. 682).

Further studies on the complement fixation reaction as applied to tuberculosis, J. D. ABONSON and P. A. LEWIS (*Amer. Rev. Tuberculosis*, 6 (1923), No. 11, pp. 1024-1034, fig. 1).—This is a general discussion of a continuation of a previously reported study of the subject by Lewis (E. S. R., 41, p. 190). The principal points investigated were the properties of the different antigenic preparations and the distributions of the antigenic substance. Using a uniform method of determining antigenic values, tuberculin, emulsions of the tubercle bacillus, various extracts of the bacillus, and extracts of the body fluids and tissues of tuberculous animals were tested for antigenic value.

Tuberculin proved to have almost no antigenic properties. This is thought to indicate that the active principle in tuberculin is an entirely different substance from the alcohol-soluble antigen for the complement fixation test. Emulsions of the tubercle bacillus, when prepared in such a way as to furnish uniform content of the bacterial substance, gave indistinguishable results as antigens. Petroff's glycerin extract, Besredka's antigen, and the alcohol extract of the tubercle bacillus are all considered to be of essentially equal worth, thus pointing to the probability that there is but one antigenic substance in tuberculosis. No antigenic substances could be found in the body fluids and tissues of tuberculous animals by extraction with alcohol.

Immunization against bovine contagious abortion, SCHERMER and EHRLICH (*Berlin. Tierärztl. Wchnschr.*, 39 (1923), No. 4, pp. 37, 38).—A brief summary is given of the authors' investigations on bovine contagious abortion.

For the microscopic detection of abortion bacilli growth on agar containing 1 per cent of glycerin is recommended. Other means of detecting the organism are the agglutination test with the blood of the aborting animal, and the inoculation of guinea pigs with suspected material and subsequent testing of their blood by the agglutination test.

Preliminary experiments having shown that the immunization of nonpregnant heifers did not lead to sterility and that the organism could not be recovered from the milk of cows vaccinated with the living organism, the following scheme was adopted for the immunization of all the cattle in an infected herd. The animals which were not pregnant were vaccinated with a suspension in 10 cc. of physiological salt solution of the living organism recovered from a glycerin agar slant. This vaccination was repeated in from 10 to 14 days. For cows in the first half of pregnancy a vaccine prepared from cultures of the organism killed by heating at 52° C. was used, and for those in the last half the so-called abortus lymph. This consisted of an extract of an old bouillon culture and was used on account of the rapidity of its absorption. Vaccination by the last two methods is considered at best only an emergency method, and after calving the vaccination should be repeated with the living organisms.

By these methods 428 animals were vaccinated in 1919, 1,171 in 1920, and 5,431 in 1921. It is stated that in a total of 14 herds 19 per cent of the animals aborted during the year before vaccination was introduced, while in the following year of those vaccinated with the living organism only 2½ per cent aborted and of those receiving the other two vaccines only 8 per cent. The authors are strongly of the opinion that immunization of the nonpregnant heifers is the best means of eradicating bovine abortion.

Histological investigations of the contagious pleuropneumonia of bovines, M. ZIEGLER (*Ztschr. Infektionskrankh. u. Hyg. Haustiere*, 22 (1921), Nos. 1, pp. 37-75, pls. 3; 2, pp. 123-150, pls. 2; 3-4, pp. 183-237, pls. 4).—A report of

histopathological studies. The literature is reviewed and references given to 50 titles.

The warble flies: Fifth report on experiments and observations as to life history and treatment, G. H. CARPENTER and J. O'N. HEWITT (*Ireland Dept. Agr. and Tech. Instr. Jour.*, 20 (1920), No. 4, pp. 452-459, figs. 4).—This is an account of the systematic destruction of warble flies that was commenced early in 1915 and has been carried on each year since on Clare Island, County of Mayo, which lies opposite the mouth of Clew Bay, 3 miles from the nearest point of the mainland. This island is 4.25 miles long and 2.5 miles at its greatest breadth, and is so far from the mainland that the migration of flies is quite improbable. There are more than 70 small farms on which cattle are kept, the bovine population of the island varying with the season from 400 to over 500. The results of the work each year, in which, so far as possible, all maggots were squeezed out from every beast on the island, are reported in detail in tabular form. In the spring of 1919 it was found that the process of extermination was nearly complete, and in the year 1920 the island cattle were entirely free from maggots. Thus the possibility of exterminating the insect on an isolated area was demonstrated, though the time required was longer than at first anticipated.

The warble flies: Sixth report on experiments and observations as to life history and treatment, G. H. CARPENTER, G. PHIBBS, and T. SLATTERY (*Ireland Dept. Agr. and Tech. Instr. Jour.*, 22 (1922), No. 1, pp. 14-25).—This report of investigations conducted, in continuation of those above noted, is supplementary to the fourth of the series (*E. S. R.*, 32, p. 680), and deals with the subject as follows: (1) Life history and habits, including muzzling experiments, feeding calves with maggots, observations on the boring-in of maggots, migration of young maggots, number of larval stages, duration of pupal stage and fly season; and (2) treatment, including the use of tobacco powder and lime wash, nicotine dressing, other dressings, injections, gas treatment, and preventive dressings.

In the course of experiments six calves were fed with 100 young maggots each and one with 45. Three of the calves were slaughtered in the autumn and their gullets examined for second-stage maggots, with negative results, and the backs of the remaining four calves were examined the following spring without detecting warbles. This experiment confirms the result of the muzzling experiments, indicating that the parasite does not enter by the host's mouth.

Observations on the boring in of maggots, here reported, give clear proof of the extensive migration of the larvae in hosts under observation and control, and show conclusively that larvae which bore in at the hock reach the back and become mature there. Attention is called to recent observations of C. Stub,¹ which tend to show that the maggot works through the tissues just beneath the skin until it reaches the neck, then goes deeper and penetrates the gullet wall from outside. The results obtained in experiments with tobacco powder and lime wash have been so satisfactory that they warrant the recommendation of the wash for general use. It is prepared by mixing 1 lb. of fresh quicklime with water, steeping 3 to 4 lbs. of tobacco powder in the lime-water for 24 hours, and then straining and squeezing out the liquid through coarse muslin. It is said to be best applied with a cloth or brush to the backs of the cattle, that it will have no effect unless it comes into actual contact with the maggots, and that the dressing should be repeated at least four times during the maggot season.

¹ *Maanedsskr. Dyrlæger*, 81 (1919), pp. 280, 281.

Nicotin sulphate, an effective vermicide for sheep, G. H. LAMSON, JR. (*Science*, 57 (1923), No. 1466, p. 149).—Experiments conducted at the Connecticut Storrs Experiment Station and extending over a period of three years have resulted in finding a 40 per cent nicotin sulphate to be the most effective dosage against stomach worms. It should be used at the rate of 10 cc. of the nicotin sulphate in 1 qt. of water, 4 oz. being given to adult sheep and 2 oz. to lambs. This treatment was used in 948 cases, and in 161 animals slaughtered 24 hours after treatment only a few live worms were found in the stomachs.

On the nature of lumbar paralysis in the goat, O. EMOTO (*Jour. Japan. Soc. Vet. Sci.*, 1 (1922), No. 1, pp. 1-34, pls. 2).—The author finds that lumbar paralysis, which occurs mostly during summer and autumn in the goats imported into Japan from Switzerland and to which the native goats are resistant, is an infectious disease characterized anatomically by spinal meningitis and spinal sclerosis, being caused by a streptococcus.

The destruction of trichinae in pork through freezing, A. MAAS (*Ztschr. Fleisch u. Milchhyg.*, 33 (1922), No. 1, pp. 1-4).—This discussion includes a review of the literature, including references to the investigations of Ransom (*E. S. R.*, 34, p. 680).

Etiology of equine contagious abortion in India, T. M. DOYLE (*India Dept. Agr. Mem., Vet. Ser.*, 3 (1922), No. 5, pp. 139-158, fig. 1).—"In an outbreak of specific abortion amongst pony and donkey mares at the Government Farm, Hissar, Punjab, investigation has shown that the causal agent in both species is *Bacillus abortivo equinus* G. & C. The organism is identical in all particulars with that described by European and American observers. The organism is capable of producing abortion in pony and donkey mares by intravenous, alimentary, and intravaginal infection. The incubation period following experimental infection by all routes is shorter in pony than in donkey mares. The average period in pony mares is 10 days and in donkey mares 19 days. The serum of infected pony and donkey mares agglutinates the *B. abortivo equinus* of either pony or donkey origin in high dilutions. The organism failed to set up joint-ill in foals either by intravenous or alimentary infection. Three cases of arthritis (two in pony mares and one in donkey stallion) were observed in adult animals as a result of the intravenous inoculation of the organism."

The control of joint-ill and of equine abortion, BERNHARDT (*Berlin. Tierärztl. Wchnschr.*, 39 (1923), No. 3, pp. 25-29).—Case reports are given of 177 instances of the use of the serum of the dam as a prophylactic or curative agent in joint-ill of foals. In general 200 cc. of the serum was used, and the injection was made subcutaneously. As shown by the case reports, the best results were obtained when the treatment was given within 24 hours after birth. The only fatalities noted were certain cases in which the treatment was not given until the foals were several days old. Occasionally a second injection was found necessary. Practical directions are given for the application of the method.

The treatment of joint-ill with the blood of the dam, BRAUMÜLLER (*Berlin. Tierärztl. Wchnschr.*, 38 (1922), No. 48, pp. 550, 551).—The author reports several cases of joint-ill which showed no response to treatment with the serum of their own dams, but recovered following similar treatment with the serum of another mare.

Treatment of mal de caderas of the horse with Bayer 205, L. E. MIGONZ and T. OSUNA (*Arch. Schiffs u. Tropen Hyg.*, 26 (1922), No. 10, pp. 386-394).—This account is based upon investigations and the experience of the authors

in Paraguay with the disease caused by *Trypanosoma equinum*. They find the administration of Bayer 205 intravenously to be most satisfactory, the curative treatment consisting in the administration of 2 gm., followed by 3 and 4 gm., respectively, at intervals of eight days. At the time of writing, after 10 months, 107 horses had been cured and 219 prophylactically treated in this way.

Blastomycosis of the nasal mucous membrane of the horse, E. JOEST (*Ztschr. Infektionskrank. u. Hyg. Haustiere*, 22 (1921), No. 1, pp. 1-12, figs. 6).—This is the report of a histopathological study conducted by the author.

Study of an organism resembling *Bacterium pullorum* from unabsorbed yolk of chicks "dead in shell," F. R. BEAUDETTE, L. D. BUSHNELL, and L. F. PAYNE (*Jour. Infect. Diseases*, 32 (1923), No. 2, pp. 124-132).—An investigation conducted in Kansas, where in the spring of 1921 attention was called to the fact that about 40 per cent of several thousand fertile eggs incubated artificially at a poultry plant failed to hatch, is here reported. The investigation resulted in the isolation of an organism from the unabsorbed yolk of some chicks dead in the shell.

"The constant finding of the organism in eggs from the same hen suggests the possibility that the hen may be a chronic carrier of the infection. This organism is closely related to members of the colon-typhoid group, and can not be distinguished from *B. pullorum* by the fermentation reactions except by the inconstant reaction of the latter on maltose and xylose. The organism appeared to be pathogenic for the developing embryos. Other members of the colon-typhoid group also appear to be pathogenic for developing embryos. A strain of *Staphylococcus aureus* and an unknown bacterium isolated from eggs failed to cause the death of the embryo in all cases when injected into fertile eggs. Fertile eggs inoculated with a small volume of sterile salt solution did not give an appreciably lower percentage of hatch than uninoculated eggs."

Notes on the parasites of domesticated fowls in Canada, A. B. WICKWARE (*Canad. Vet. Rec.*, 3 (1922), No. 3, pp. 142-146).—Observations made during the course of survey work with parasites of poultry are here brought together.

RURAL ENGINEERING.

Experimental field for agricultural hydrology, M. CONTI (*Rev. Facult. Agron. La Plata*, 3. ser., 14 (1921), No. 3, pp. 97-121, pl. 1, figs. 8).—A description of the experimental irrigation field at the Universidad Nacional de La Plata is presented, together with a plan of the studies being conducted, analyses of the soils, meteorological data, descriptions of water-measuring devices, and typical results obtained with corn, peanuts, and potatoes. The general plan of the studies includes duty-of-water experiments, comparisons of methods, amounts, and frequencies of irrigation, and investigations into the effect of mulches and cultivation on water economy. The field is so laid off that dry farming and irrigated farming can be directly compared.

Discharge through adjustable submerged orifices, H. A. WADSWORTH (*Engin. News-Rec.*, 90 (1923), No. 7, pp. 308, 309, figs. 6).—Experiments conducted by the University of California and the Colorado Experiment Station, in cooperation with the U. S. Department of Agriculture to increase the accuracy of the adjustable submerged orifice as a means of measuring irrigation water, are briefly described.

It was found that the size of the opening of a submerged orifice and the contractions and suppressions are deciding factors in determining the discharge. From the results of the experiments, a new formula was devised, in which

$$Q = CA\sqrt{2g} \times H^{0.484}.$$

Tabular and graphic data of the tests based upon this

formula are presented covering a range of discharge of from 0.5 to 13 sec.-ft. and a range of areas of from 0.3 to 8 sq. ft.

Diagrams for submerged Cippoletti weirs, W. G. STEWARD (*Reclam. Rec. [U. S.], 14 (1923), No. 1, pp. 30, 31, figs. 2*).—Diagrams for submerged Cippoletti weirs are presented and discussed, based on experiments conducted from time to time by the U. S. Reclamation Service.

Seepage from earth canals in Texas, W. F. HEATH (*Engin. News-Rec., 89 (1922), No. 25, p. 1075*).—It is stated that tests for seepage and evaporation in one of the canals of the San Benito irrigation district, Texas, indicate that 92 per cent of the total loss is seepage and 8 per cent evaporation. Spread over the whole district these losses amount to nearly 1 acre-foot per acre. Canal lining and drainage on each side of the canals are suggested, the first to reduce seepage to a minimum and the second to minimize its harmful effects.

[Deterioration of concrete in alkali soils], C. J. MACKENZIE (*Engin. Jour. [Canada], 6 (1923), No. 2, pp. 57-63*).—This is a report of a special committee of the Engineering Institute of Canada, appointed to investigate the deterioration of concrete in alkali soils. The scope of the investigation includes a thorough chemical study of the subject. The results to date are given, but no conclusions are drawn.

Contraction and expansion of concrete roads, D. L. JANTZ (*Agr. Engin., 3 (1922), No. 12, pp. 201, 204*).—Field and laboratory studies to determine the actual expansion and contraction of concrete and concrete roads and to obtain data for the spacing of expansion and contraction joints in concrete roads are presented in this report, contributed by the Kansas State Agricultural College. In the laboratory, contraction and expansion tests were made on concrete specimens of various mixtures, and in the field both transverse and longitudinal measurements of the movements of concrete were made.

The results are taken to indicate that concrete laid at a temperature slightly above freezing should be provided with expansion joints, as the expansion due to summer temperature greatly exceeds the contraction on drying out. Concrete laid in the summer does not require expansion joints, but should be provided with contraction joints at intervals of from 25 to 30 ft.

The results of physical tests of road-building rock from 1916 to 1921, inclusive (*U. S. Dept. Agr. Bul. 1152 (1923), pp. 52*).—This bulletin gives the results of tests of all rock made by the Bureau of Public Roads from January 1, 1916, to January 1, 1922, classified alphabetically according to location. It supplements Bulletin 370 (*E. S. R., 35, p. 685*) and replaces Bulletin 670 (*E. S. R., 39, p. 493*).

What the Arlington [roads] investigations are showing, A. T. GOLDBECK (*Engin. and Contract., Roads and Streets, 59 (1923), No. 2, pp. 301-312, figs. 13*).—The experiments being conducted by the U. S. D. A. Bureau of Public Roads at the Arlington Experiment Station on the structural design of roads and on the properties of road materials are briefly outlined, and some of the more important results already obtained are summarized.

The investigations of the physical characteristics of subgrades have indicated that soils having practically the same mechanical analysis may be entirely different in their bearing values, moisture contents, and volumetric changes, and that the character and quantity of clay in a soil materially affect its ability to absorb moisture and to retain it under the action of a centrifugal force equal to that of 1,000 times the force of gravity. Soils having approximately the same clay content may take up entirely different quantities of capillary moisture due to the character of the clay content.

Studies of the factors of the bearing values of soils, while not conclusive, have indicated that when the moisture index or the ratio of the volume of moisture to the apparent volume of solid content of the soil is less than unity, the bearing value will be high. When the moisture index of the soil is above unity, high bearing values can be obtained provided the adsorption of the soil is high. Soils having a moisture index greater than unity and low adsorptive powers almost invariably have low bearing values. Special tests have shown that the bearing value of the soil having penetrations of the bearing block equal to 0.1 in. varies greatly with the size of the bearing block, and that when small bearing areas are used the results are far higher and not at all indicative of the bearing value of the soil for supporting a pavement.

In studies on the treatment of poor subgrades by the admixture of foreign materials, both hydrated lime and Portland cement greatly decreased the volumetric change of a poor soil and very greatly increased the bearing value, so that such admixtures are considered to be decidedly beneficial.

The progress of studies on 10 different types of subgrade drainage has indicated that tile drainage will remove water only in excess of capillary moisture, and that a low temperature at the surface accelerates the movement of capillary moisture.

The results of preliminary investigations to determine the static load-supporting value of different thicknesses of broken stone base and concrete base, supported on a very wet clay subgrade and on a dry sand subgrade, have shown that with the broken stone base on wet clay the maximum intensity of pressure on the subgrade decreases with the thickness of the base, at least until failure has begun. In general, the thicker the base the higher is the load carrying capacity, and the higher can the pressure intensity on the subgrade be before failure takes place.

The results of the impact tests which have been noted from time to time are also reviewed, and new investigations now under way are briefly described.

The durability of fence posts, J. C. WOOLEY (*Missouri Sta. Circ. 108 (1922), pp. 4, figs. 2*).—This circular contains the details of the studies on methods of prolonging the service of wood fence posts previously noted (*E. S. R.*, 48, p. 680), together with the progress results to date.

It is noted that neither setting in gravel nor charring the posts has been of any value. The method of hot treatment with creosote is briefly described, and cost data are included. It costs about 4 cts. per post for the 2-hour treatment and 8 cts. for the 5-hour treatment, including creosote, fuel, and labor. An estimate of the cost of the different classes of posts in the fence over a period of 25 years indicates that three of the fourth-class posts can be purchased for the price of one of the first-class variety, but the treatment and replacement in the fence line during a period of 25 years brings the total cost to practically 70 cts. per post in the fence as compared to 50 cts. per post where one post of the first class is used.

Economic motor fuel volatility, R. E. CARLSON (*Jour. Soc. Automotive Engin.*, 12 (1923), No. 2, pp. 139-150, figs. 14).—This is a report of an investigation made by the U. S. Bureau of Standards to secure data for use as a basis in estimating the effect of a change in gasoline volatility on the fuel consumption of internal-combustion engines now in service throughout the United States. Actual tests begun in 1922 to determine the effect of four fuels of different characteristics on the accomplishment obtainable per gallon of fuel as well as on crank case oil dilution are described.

It is concluded from these tests that, on the basis of the number of miles per barrel of crude oil, the advantage among the fuels lies with that of lowest

volatility when used under summer conditions. It is stated that whether the use of this fuel represents a real economic gain depends on whether its use will result in disadvantages of sufficient magnitude to offset the gain in the number of miles per gallon of crude oil.

Manufacture of industrial alcohol and alcohol motor fuel in the Philippine Islands, H. I. COLE (*Philippine Jour. Sci.*, 21 (1922), No. 1, pp. 17-47, pl. 1, figs. 3; *abs in Chem. Age* [New York], 30 (1922), No. 11, pp. 489-492).—Considerable data on the manufacture of alcohol, primarily for use as fuel in internal-combustion engines, are summarized in this paper.

It has been found that nipa palm and molasses offer cheap and easily manipulated sources of alcohol for use as motor fuel, although it is thought that alcohol alone will probably not be used as a motor fuel until a new type of high-compression, slow-speed engine is developed.

Vegetable oils as colonial fuels for internal-combustion engines, H. JUMELLE (*Agron. Colon.*, 7 (1922), No. 59, pp. 345-354).—A summary is given of experience in the use of vegetable oils as fuels for internal-combustion engines in the French African colonies. These oils include, among others, palm, copra, peanut, and sesame. The two latter oils are said to have the highest calorific values, and all compare quite favorably in this respect with gasoline and benzol. They have considerably higher calorific values than alcohol, crude tars, and producer gas.

Tests of palm oil in tractor and stationary engines are described. Laboratory and plowing tests with a Swedish tractor equipped with a 16 h. p. semi-Diesel motor showed that about the same results were accomplished with palm oil as with kerosene, but that the unit consumption of the palm oil was apparently somewhat greater.

On the characteristics of cylindrical journal lubrication at high values of the eccentricity, T. E. STANTON (*Roy. Soc. [London], Proc., Ser. A*, 102 (1922), No. A 716, pp. 241-255, figs. 6).—Studies of cylindrical journal lubrication are reported, in which it was found that by increasing the difference between the radius of the bearing and that of the journal to an extent very much in excess of ordinary practice, it was possible to obtain steady conditions of lubrication with an arc of contact of the oil film as small as 15° , the fluid pressure in the film amounting to as much as 3.5 tons per square inch.

From the observed pressure distribution in the film, it was found possible to predict the angular position of the point of nearest approach of the journal and bearing, and hence, by a comparatively simple calculation, to obtain from the theoretical expression for the pressure slope the values of the eccentricity of the bearing and the mean viscosity of the lubricant. In the case of a journal 1 in. in diameter, it was found that the ordinary equations of motion of a viscous fluid held for flow between the inclined surfaces at a distance apart of 0.00005 in.

In all the cases of cylindrical bearings under steady lubrication conditions which were examined, the actual measured distribution of pressure was found to agree fairly closely with the theoretical distribution obtained from the integration of the equations of motion of a film of lubricant separating two surfaces of the same dimensions, attitude, and eccentricity as the existing bearing and journal, the film having the same viscosity as that of the lubricant actually used.

Our broadening knowledge of lubrication, A. E. DUNSTAN and F. B. THOLE (*Chem. and Metall. Engin.*, 28 (1923), No. 7, pp. 299-302).—A review is given of recent chemical and physical researches that have brought about a better understanding of the composition and properties of mineral lubricating oils, and a program is suggested for future research on the subject.

Testing oiliness by friction-testing machines, W. H. HERSCHEL (*Chem. and Metall. Engin.*, 28 (1923), No. 7, pp. 302, 303).—The methods of measuring oiliness of lubricants and of analyzing the results used in the U. S. Bureau of Standards are briefly described.

Internal-combustion engine characteristics under high compression, J. H. HOLLOWAY, H. A. HUEBOTTER, and G. A. YOUNG (*Jour. Soc. Automotive Engin.*, 12 (1923), No. 1, pp. 111–117, figs. 11).—The results of a series of studies, conducted during the summer of 1922 at the engineering experiment station of Purdue University, on the operation of internal-combustion engines under comparatively high compressions on ordinary gasoline without detonation are reported. The compression ratio of the engine used was 6.75 and the compression pressure was 122 lbs. per square inch. The ingoing charge was passed through a hot-spot vaporizer and thence through a cooler between the carburetor and the valves. Jacket water temperatures between 150 and 170° F. were carried at the outlet port of the jacket.

The results are taken to indicate that automotive engines designed to give a uniform cooling of the combustion chamber walls will permit the use of much higher compression ratios than those employed at present, with a consequent gain in engine power and economy. The fuel-air ratio for maximum economy was found to border upon the lean limit for reliable combustion. For maximum power the mixture ratio need not exceed 0.075 lb. of gasoline per pound of dry air. With concentrated heating of the mixture at the carburetor outlet, a local temperature of 125° was sufficient to give good operation at full throttle. Cooling to 100° at the valves was found to be desirable if the compression pressure of the engine is high. At part loads a hot-spot temperature of 175° with or without intermediate cooling gave good results with lean mixtures.

It is concluded that the power of an engine can be increased 25 per cent by a change in the compression ratio from 4.45 to 6.75, provided detonation is absent. With the same change in the compression ratio, the thermal efficiency is raised from 7 to 12 per cent through a load range of from 25 to 100 per cent of the engine power.

Motors of machines for mechanical cultivation, G. PASSELÈGUE (*Ann. Inst. Natl. Agron.*, 2. ser., 16 (1922), pp. 167–196, figs. 9).—A description is given of methods of studying tractor motors at the Station d'Essais de Machines of l'Institut National Agronomique of Paris, and the results of typical studies on motors of varying sizes, speeds, and numbers of cylinders are presented and discussed to show how different basic relations are arrived at. Special attention is paid to studies of the influence of different types and grades of fuels, and their influence on the accomplishment of different motors is graphically presented.

Torsion of crankshafts, S. TIMOSHENKO (*Mech. Engin.* [New York], 45 (1923), No. 2, pp. 96–98, figs. 4).—This is a mathematical analysis of the case of a crank shaft with a single throw, covering (1) no constraint, corresponding to ample clearance in the bearings; (2) complete constraint, corresponding to no clearance in the bearings; and (3) partial constraint, corresponding to ample clearance in the halves of the bearings nearest the web and no clearance in the other halves.

The analysis brings out the effect of the constraint at the bearings. The more complete it is the stiffer is the shaft and the shorter the reduced length. The calculations further show that an increase in the diameters of journal and pin and an increase in the length of the pin cause a reduction of the effect of constraint and of bearing pressures. On the other hand, an increase

in the thickness of the web brings about an augmentation of the bearing reactions.

Choosing a tractor (for a Corn Belt farm), L. A. REYNOLDSON and H. R. TOLLEY (*U. S. Dept. Agr., Farmers' Bul. 1300 [1922], pp. II+13, figs. 4*).—This is No. 6 of this series of publications. Its purpose is to aid the Corn Belt farmer in choosing the size of tractor best suited to his farm and the work to be accomplished, and to point out conveniences to look for and the importance and value of service. It is said to be based largely upon the experience of tractor owners.

Cost of using tractors on Corn Belt farms, L. A. REYNOLDSON and H. R. TOLLEY (*U. S. Dept. Agr. Farmers' Bul. 1297 [1922], pp. 15, figs. 6*).—This bulletin is No. 3 of the series previously noted (*E. S. R.*, 48, p. 786). It deals with the various items of the cost of tractor operation on Corn Belt farms and the possibilities of a reduction of these costs. The principal elements of cost of use are said to be, in the order of their relative importance, depreciation, fuel, repairs and upkeep, interest, and lubricating oil.

Shall I buy a tractor (for a Corn Belt farm)? L. A. REYNOLDSON and H. R. TOLLEY (*U. S. Dept. Agr., Farmers' Bul. 1299 (1922), pp. II+10, figs. 4*).—This is No. 5 of this series of publications. It discusses the various points to be considered by the Corn Belt farmer when deciding whether to buy a tractor or to continue to farm wholly with horses.

[History of the development of the harvester], J. WOODMAN (*Mich. Farmer*, 160 (1923), No. 8, pp. 271, 277).—This is a brief review of the important points in the development of the harvester.

Uses of electrical energy in agriculture (*Elect. World*, 81 (1923), No. 5, pp. 268-270, figs. 4).—This is a review of a paper presented before the Institution of Electrical Engineers in Great Britain, by R. B. Matthews, describing experiences on the uses of electrical energy in agriculture on the European Continent. It is stated that the annual consumption of electricity in farm buildings alone is proportional to the size of the whole farm and averages 10 kw. hours per acre. The probable energy consumption on a well-equipped farm should total 44 kw. hours per acre of arable land for plowing, cultivation, electroculture, silage cutting, harvesting, etc.

From a study of results on the Continent and in England and from experience in the operation of a 600-acre farm, the conclusion is drawn that the successful solution of the application of electricity to farming is not merely a matter of belting a standard motor to existing machinery. One of the more important problems in this connection is the limited seasonal use of much of the machinery, and the further point is brought out that a large portion of the labor available is not accustomed to and prejudiced against such machinery. It is maintained that an increased efficiency in farming operations in Europe, including some circumvention of adverse weather conditions, is obtainable by using electrical energy.

Milking machines, water pumps, cream separators and other dairy equipment, electric lighting, electrical stimulation of egg production, incubator heating, household appliances, and other smaller fields for the use of electricity seem to have had about the same consideration as in the United States. Electroculture and the use of electrical energy for the major farm operations have, on the other hand, received greater attention both in England and on the Continent than in the United States. Plowing especially has received considerable notice, and five methods in use are described, including the storage battery, cable, electrically hauled plow, and single cable-winding device methods, and a so-called roundabout steam system. The first two methods are dismissed as being unsatisfactory, and the obstacle to the third or double haulage system

is the cost of equipment. A system compromising between the double haulage and so-called roundabout systems is considered to be the most practicable for ordinary farms, and the outlay for the roundabout equipment is said to be reasonable. The power required is from 12 to 60 h. p.

Everything seems to indicate that the conditions governing the use of electrical energy for farming operations in Europe and the United States are not comparable.

Spontaneous combustion in hay mows and stacks, E. P. HEATON, J. E. RITCHIE, and C. H. COWAN (*Toronto: Fire Marshal Off., 1921, pp. 43*).—The results of investigations of 400 fires on farms are briefly presented, indicating that the modern bank barn with close siding, frequently battened on the outside, and with inadequate gable and roof ventilation is a contributing cause to spontaneous combustion.

It is concluded that crops such as alfalfa and clovers can not be properly cured and placed in condition to be housed by the same procedure used with crops such as timothy. Crops upon which rain has fallen should not be housed until thoroughly and completely dry, and after being housed no water from rain or otherwise should be permitted to fall thereon. The practice of placing grain in the sheaf, baled hay, and straw above hay mows, compressing the hay and preventing the escape of gas, is considered to encourage so-called spontaneous combustion very materially, and the old-time process of salting hay is considered to be an effective means of retarding combustion. Stacks of hay or straw should never be built upon old footings, particularly when manure has been dumped thereon.

The investigations indicate that the hay loader is frequently used to take up the crop from windrows without cocking or coiling. This practice is considered to be indefensible, and it is believed that speeding up by the aid of machinery necessarily means imperfect curing and invites spontaneous combustion. It is stated that nearly every county in Ontario during the year 1921 had mysterious barn fires occurring between the hours of 6 a. m. and 9.30 p. m., usually in the months immediately following harvesting or threshing.

Oregon Experiment Station trap nest, A. G. LUNN and F. L. KNOWLTON (*Oregon Sta. Circ. 33 (1923), pp. 4, figs. 2*).—A plan, with the description of the method of constructing a single compartment trap nest, is presented.

Mechanical devices in the home, E. ALLEN (*Peoria, Ill.: Manual Arts Press, 1922, pp. 251, figs. 162*).—This is a popular treatise giving information on cooking and heating devices, lighting fixtures, refrigeration, plumbing, laundry appliances, and small power and light plants.

A simple hot and cold water system for the kitchen, J. B. KELLEY and E. G. WELCH (*Ky. Agr. Col. Ext. Circ. 139 (1922), pp. 8, figs. 2*).—A system adapted to middle western farm conditions is described and diagrammatically illustrated, and a bill of material for an average installation is included.

The home radio set, A. H. DRESNER (*Conn. Agr. Col. Ext. Bul. 56 (1922), pp. 12, figs. 10*).—This bulletin briefly explains the construction and operation of a simple radiophone receiver.

Preliminary note on the purification of water by activated silt, G. J. FOWLER and R. R. DEO (*Jour. Indian Inst. Sci., 4 (1921), No. 9, pp. 149-157*).—Studies on water purification by means of so-called activated silt prepared by wetting, bacterization, and aeration of common river silt are reported.

Laboratory experiments showed that such activated silt is capable of causing the rapid oxidation of dissolved organic matter in polluted water. Further studies showed that the continuous addition of even small quantities of sewage or polluted water to a silt-laden stream tends to hasten silt deposition.

RURAL ECONOMICS AND SOCIOLOGY.

Agricultural economics (*U. S. Dept. Agr., 1922, pp. 107*).—The following papers, assembled in mimeographed form, were prepared for publication in a number of agricultural college journals for the purpose of stimulating interest on the part of agricultural students in the field of agricultural economics: The Field of Agricultural Economics, by H. C. Taylor; Organization for Production, by G. W. Forster; Cost of Production and Distribution, by H. E. Erdman; Land Problems of the New Era, by L. C. Gray (*E. S. R., 48, p. 593*); Prices of Farm Products, by N. C. Murray; Agricultural Readjustments, by O. C. Stine; Agricultural Geography, by O. E. Baker; Short-time or Personal Credit for Farmers, by V. N. Valgren; Farmer Movements and Marketing, by B. H. Hibbard; Marketing Functions, by T. Macklin; Market Inspection of Perishable Products, by W. A. Sherman; Market News Services and Information, by W. A. Wheeler; Agricultural Competition and Demand, by W. F. Callander; Agricultural Legislation, by C. Morrill; Extension Service in Agricultural Economics, by H. C. Taylor; The Sociology of Farm Populations, by C. J. Galpin; The Standardization of Farm Products, by H. W. Samson; and Fundamentals of Cooperative Marketing, by G. H. Powell.

Cost of using horses on Corn Belt farms, M. R. COOPER and J. O. WILLIAMS (*U. S. Dept. Agr., Farmers' Bul. 1298 (1922), pp. 2+16, figs. 9*). The approximate cost of keeping a work horse was computed for 1921 by applying the current average prices to the quantity requirements obtained from 1909 to 1920 from 279 farms located in Madison and Seneca Counties, Ohio, Madison and Montgomery Counties, Ind., Livingston and Knox Counties, Ill., four counties in western Illinois, and in Iowa County, Iowa. These farms averaged about 200 crop acres each, and the cost of keeping the work stock amounted to \$702 per farm. Tractors were used in addition to horses, however, and this figure does not represent the entire average cost of motive power per farm.

The annual cost of keeping six horses at \$99.21 per head on a 160-acre farm amounted to \$595, of which \$358 was required for feed and bedding, \$67 for the labor involved in their care, \$41 for interest, \$41 for stabling, \$37 for depreciation, \$27 for harness costs, \$13 for miscellaneous expenditures, and \$11 for shoeing. The average cost of feed and bedding amounted to about \$64 per horse. On the 279 farms the total time spent in feeding and caring for an average of seven work horses amounted to 467 hours per farm for the year, or about 66 hours per head. The horses on these farms were used an average of 723 hours each per year.

The net decrease or depreciation in the inventory values of work stock on the farms covered in this investigation amounted to \$6.70 per head per year, or about \$47.50 per farm. In discussing the item of interest, farm prices of work horses through a period of years are noted and interest is figured at 6 per cent on the average value. The average farm price of horses on the farms visited was nearly \$144 in 1920 and about \$123 in 1921. The average cost of stabling horses in the Corn Belt was slightly over \$7 per head, and the maintenance cost of harness and other horse equipment amounted to \$4.78 per head. In some of the Corn Belt areas shoeing was not at all general, while in others the cost averaged between \$3 and \$4 per head. On the basis of 10 hours work, the average cost per day was \$1.37.

On horse-operated farms the average number of acres of crops tended per horse in different sections of the Corn Belt varies from 18 to 24.

Wheat costings, 1914 and 1919-1922, H. GRANGE (*London: P. S. King & Son, Ltd., 1922, pp. 16*).—The various items of cost of wheat production on a farm of 348 acres in Hertfordshire, England, are given here.

The land and its problems, C. TURNOR (*London: Methuen & Co., Ltd., 1921, pp. 254, pls. 7, figs. 3*).—This is a consideration of the twofold problem of the development and utilization of the land resources of the British Empire and the welfare of the cultivator. The author stresses the need of occupying ownership, of the farming by the landowner of more land more intelligently, and of efficient laborers.

General results of British and continental systems of agriculture are compared. The methods of producing specific crops in Great Britain are discussed with a view of certain shortcomings. The relative production on small and large holdings is considered. It is maintained that the importance of the small holder must not be lost sight of, and that as soon as circumstances permit the development of small holdings should be pushed again. The average production per acre seems to be higher than the general average for the country, and the same is true with regard to profits.

The importance of farm accounts and demonstrations and other means of technical education is stressed. An objective policy for production and the future development of agriculture at home and in the Empire are outlined.

Rural credits system for the United States, H. MYRICK (*New York: Orange Judd Pub. Co., 1922, pp. 239, pl. 1, figs. 5*).—Principles of rural credit and Federal and local institutions that would be set up by and miscellaneous features of a system which the author has devised are discussed in nine chapters. The full text of the bill embodying the author's proposed system is given in the appendix.

[**Annual report of the Jewish Agricultural Society, Incorporated, for the year 1922**], D. DAVIDSON (*Jewish Agr. Soc. Ann. Rpt. 1922, pp. 72*).—This continues information previously noted (*E. S. R.*, 46, p. 693).

Agricultural wage earners in the United States, V. B. TURNER (*U. S. Dept. Labor, Bur. Labor Statis., Mo. Labor Rev.*, 15 (1922), No. 6, pp. 22-40).—This article consists of a compilation and interpretation of census data, setting forth farms and the rural population in the United States in 1910 and 1920, as well as the number of agricultural wage earners, classes of workers and the character of their work, wages, cost of living, hours, methods of hiring and paying, and the relation of supply to demand. Other problems briefly discussed are recruitment and distribution, character of housing, seasonal labor, the wage earner's opportunity of acquiring land, and schemes for land settlement.

Report on investigations with regard to harvest labor, DERLITZKI and WEBER (*Illus. Landw. Ztg.*, 42 (1922), No. 67-68, pp. 275, 276, fig. 1).—Studies were made of the time expended by the individual members of groups when working together in the harvesting of wheat, rye, and oats. It appeared that the time and energy required for the separate operations varied considerably, and that the efficiency of the group was impaired by the inequalities in the tasks assigned its members.

Marketing the cowpea seed crop, J. E. BARR (*U. S. Dept. Agr., Farmers' Bul.* 1308 (1923), pp. 27, figs. 7).—Suggestions are made with reference to threshing, recleaning, sacking, and storing cowpeas intended for seed, as well as in connection with selling to neighboring farmers, local shippers, distant seedsmen, and through farm-paper advertising. The seasonal trend of wholesale selling prices, sectional price variations, and the relation of variety to price through recent years are tabulated and presented graphically.

Cooperation in marketing Kansas wheat (*Kans. State Bd. Agr. Quart. Rpt.*, 41 (1922), No. 162, pp. 133, figs. 20).—A number of articles on marketing wheat in Kansas and on other forms of cooperative packing and marketing activities have been compiled for this report.

The American farmer and foreign markets (*Commerce Mo.*, 4 (1923), No. 11, pp. 3-11).—Statistics of production and exports of American agricultural products and of the percentage distribution among the countries of destination are presented, with interpretation. Indirect as well as direct adjustments between international prices and supply are pointed out, and it is held that the American farmer is much more directly concerned with the international market than is the American manufacturer. The values of farm products are said to be determined on the basis of the actual world situation.

Report on the Emergency Tariff Act of May 27, 1921 (*Washington: U. S. Tariff Comm.*, 1922, rev. ed., pp. IV+142).—The effect on prices of the emergency duties is brought out by means of detailed studies of the production, exports and imports, and prices in recent years of each of the items mentioned in the Emergency Tariff Act. It is stated that in practically no case did the prices rise immediately after the passage of the act, although the downward swing was checked in the fall and winter of 1921. It is also noted that in some cases a decrease of imports, as well as a continued decline in agricultural prices in this country, preceded the enactment of the emergency law. This was particularly true with respect to beans, corn, and certain meat products.

State of Michigan, laws relating to the department of agriculture ([*Lansing: State Dept. Agr.*], 1921, pp. 245).—A State department of agriculture was created in Michigan in 1921, and the powers and functions of the State with regard to agriculture were transferred to it. The laws under which it operates are codified here.

Some factors in town and country relationships, A. W. HAYES (*New Orleans: Tulane Univ. La., Dept. Sociol.*, 1922, pp. 46, figs. 4).—The trade, social, church, health, and educational relationships of Alexandria, Oakdale, and Cheneyville, La., as well as certain smaller centers and hamlets, are described in detail, and some of the trade areas determined in the course of the survey reported here are mapped. Proof is said to have been developed through this investigation to show that on many of the problems involved in town and country relationships the farmer and townsman must work together with equal integrity and cooperative spirit. Programs calling for change and progress should rest upon carefully drawn plans.

The English village, H. PEAKE (*London: Benn Bros., Ltd.*, 1922, pp. 251, pl. 1, figs. 13).—The first eight chapters of this book trace the origin of the agricultural village community in the light of recent anthropological and archaeological research in Europe, but principally in the British Isles. The next four set forth the conflict between Saxon and Norman racial ideals, particularly in southern and eastern England or in Wessex. The last chapters follow the decay of the manorial system and later agrarian revolutions, including those of the nineteenth century. The ideal village of the future is described as one based on individualism, strongly tempered with the cooperative principle. A bibliography is included.

The country church in industrial zones, H. N. MORSE (*New York: George H. Doran Co.*, 1922, pp. XVIII+19-121, figs. 33).—This belongs to the Town and County Series previously noted (*E. S. R.*, 48, p. 493).

The work of town and country churches in Columbia County, Pa., and Harford County, Md., is set forth here. The history, equipment and finances, membership, services and church organization, their Sunday schools, young people's societies, and community programs were investigated in the spring and summer of 1921. A chapter on Service to Migrants is contributed by E. R. Hooker.

The general situation in these counties was found to be good. Recommendations are made covering denominational supervision, interdenominational cooper-

ation, village and country church relationships, financial methods, Sunday schools and other organizations, conditions of pastoral work, and coordination of church activities. More cooperation between churches is urged.

Appendixes contain a description on methods used in the survey and tabulated returns.

Maternity and child care in selected rural areas of Mississippi, H. M. DART (*U. S. Dept. Labor, Children's Bur. Pub. 88 (1921), pp. 60, pls. 2*).—A county in the southern part of the State was chosen as the field for a series of children's health conferences, and an intensive survey of maternity and infant welfare was carried out in a county in the northern part of the State typical of the hill country with respect to the conditions of child care, general economic and farming conditions, and the racial and industrial distribution of the population. Information was obtained in regard to 685 babies, of whom 299 were white and 386 colored.

There were 14 physicians in active practice in the northern county studied. The nearest hospital was 100 miles away. Children as well as mothers suffered from lack of skilled medical and nursing care. Incomplete birth and death registration handicapped authorities in studying the problem of infant mortality.

It is concluded that the most necessary steps in improving the situation are the employment of a public health nurse for the county and a county or district full-time health officer, the establishment of a county hospital with free care available for those unable to pay, provision for the training and supervision of midwives, and the enforcement of the birth and death registration law.

Agricultural cooperation in England and Wales, W. H. WARMAN (*London: Williams & Norgate, 1922, pp. VI+204, pl. 1*).—This is a short account of the early years, postwar developments, and present position of agricultural cooperation in England and Wales and of the cooperative disposition of specific commodities, including dairy products, meat and wool, fruit, vegetables, and eggs.

On December 31, 1920, there were 1,113 allotment and small holdings societies affiliated with the Agricultural Organization Society. This branch of cooperative activity, problems of finance and credit, the work of the society, and the future of cooperation are discussed.

Appendixes contain communicated reports.

[**The rôle of agriculture in the economic development of the United States**], I. LIPPINCOTT (*In Economic Development of the United States. New York and London: D. Appleton & Co., 1921, pp. 57-82, 149-174, 362-414*).—The author describes the agriculture of the colonial period of American history, and traces its development between 1790 and 1860 and its expansion between 1860 and 1914. Governmental encouragement in the way of the establishment of experiment stations, the Federal farm loan system, and a general irrigation policy is set forth in detail.

Agricultural charts, eastern cotton States, based on United States census figures, 1920, J. N. HARPER and D. D. LONG (*Atlanta, Ga.: Soil Impr. Com., South. Fert. Assoc., pp. [32], figs. 32*).—The improved acreage, soil regions, average consumption of fertilizers per county, average returns by counties of all crops, expenditures for fertilizers, crop acreage and crop values, crop distribution, and crop yields are graphically presented on maps of the Southern States.

Rural California, E. J. WICKSON (*New York: Macmillan Co., 1923, pp. XIV+399, pls. 12*).—This is one of a series previously noted (*E. S. R.*, 48, p. 391). The ten chapters set forth physical and climatic characteristics, the soils; the history and development of agriculture; agricultural industries, plants, and

crops; animal industries; cooperative organizations; improvements in irrigation practice and in highways; governmental work for country life; and educational and research organizations of California. Statistical appendixes are included.

The development of agriculture in Canada, J. H. GRISDALE (*Canada Yearbook, 1921*, pp. 202-210).—This is a review of the history of agriculture in Canada by Provinces.

An outline of the history of agrarian systems in Europe in the eighteenth and nineteenth centuries, H. SÉE (*Esquisse d'une Histoire du Régime Agraire en Europe aux XVIII^e et XIX^e Siècles*. Paris: Marcel Ghard & Co., 1921, pp. [4]+ 276).—In part 1 the author traces comparatively the development of the institution of property in land and typical agrarian régimes in France, Germany, England, Ireland, northeastern Europe including western Prussia, Poland, Denmark, and the Russian Baltic Provinces, and Russia proper. The effect of the increase of capital is particularly emphasized. Part 2 is concerned with the emancipation of the peasants and their enfranchisement at the end of the eighteenth and in the nineteenth centuries.

An economic résumé, 1922, G. MORTARA (*Prospettive Economiche, 1922*. Milan: Univ. Bocconi, 1922, pp. XX+384).—This is a statistical and analytical study of the production of raw materials, fuel, and power, and the extent of transportation facilities in the more important countries, with special reference to Italy and her economic potentialities.

Pastoral and agricultural [production in Australia], A. W. FERRIN (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Spec. Agents Ser., No. 216 (1922)*, pp. 74-99, pls. 5, figs. 3).—These pages of a report by a former U. S. trade commissioner to Australia present a statistical survey of the resources of this region and the system of land tenure found there.

Drovers Journal yearbook of figures of the live stock trade, 1922 (*Chicago: Daily Drovers Jour., 1923*, 22. ed., pp. 104, fig. 1).—Statistics previously noted (*E. S. R.*, 47, p. 298) are continued, and some new tables have been added.

Farm acreages, values, ownership and tenancy, production of principal crops by counties, [and other farm statistics for Texas], R. E. YANTIS (*Tex. Dept. Agr. Bul. 70 [1922]*, pp. 42, pl. 1).—This publication combines data from the United States census of 1920 relating to the production of the principal crops of Texas, live stock, and oil, together with the number of farm owners, tenants, resident and nonresident landowners, and large holdings of land by individuals and corporations. It contains a colored products map and statistics of mortgage indebtedness by counties, cost of labor, fertilizer, and feed purchases on the farm, and other items.

[Agriculture in Canada] (*Canada Yearbook, 1921*, pp. 210-301, fig. 1).—Tabulated statistics, with notes interpreting them, are given here, setting forth agricultural, live stock, fruit, and dairy production and prices in continuation of a previous report (*E. S. R.*, 46, p. 496).

[Agriculture in Venezuela], H. H. D. BEAUMONT (*In Report on the Economic and Financial Conditions in Venezuela, September, 1922*. London: [Gt. Brit.] Dept. Overseas Trade, 1922, pp. 7-9).—Statistics showing production and exports of important agricultural commodities in recent years are given.

[Land tenure and settlement and agricultural production in Australia], C. H. WICKENS (*Aust. Off. Yearbook, No. 15 (1922)*, pp. 150-308, figs. 6).—Annual statistics are given which continue the series of reports previously noted (*E. S. R.*, 46, p. 895).

[Agricultural statistics of British India] (*Brit. India Statis. Abs., 55 (1911-1920)*, pp. 128-136).—These annual statistics, with summaries through a number of years, continue information previously noted (*E. S. R.*, 46, p. 293).

AGRICULTURAL EDUCATION.

Education and research in agriculture and home economics in the United States. A. C. TRUE (*U. S. Dept. Agr.*, 1923, pp. 45, figs. 24).—This report was prepared for the Commission of the United States of America to the Brazil Centennial Exposition, 1922-23.

The history of the movement to give State and Federal aid for the creation of colleges in which the sciences and their application to agriculture and other industries would be taught and to establish the various agencies for research in agriculture and home economics is outlined, and the work in progress is briefly described. Two types each of institutions for higher and secondary education in agriculture are pointed out, namely, colleges of agriculture in universities and separate colleges in which instruction in agriculture is combined with instruction in mechanic arts, home economics, and a variety of other subjects; and special agricultural schools and departments of ordinary secondary schools. The provisions for the teaching of agriculture in the public elementary schools, at least in rural communities, are noted. Extension work in agriculture and home economics is described, as are also elementary, secondary, and higher education and research in home economics.

The Massachusetts attack on Federal aid. C. A. PROSSER (*Vocat. Ed. Mag.*, 1 (1923), No. 6, pp. 403-409).—This is an analysis of the contentions in the Massachusetts petition to the U. S. Supreme Court that cooperation between the Federal Government and the States as provided in the Sheppard-Towner Act and others making similar grants of aid establishes joint national and State enterprise not authorized by the Constitution. The author holds that the use of Federal moneys by a State sets up a contractual relation between it and the National Government not forbidden by the Constitution. The real contest is said to be between Massachusetts as one of the 48 States and the other States of the Union insisting upon their constitutional right to make a free contract not to be abridged on the objection of another State.

Proceedings of the department of rural education of the National Education Association (*Natl. Ed. Assoc. U. S. Addresses and Proc.*, 60 (1922), pp. 1099-1222, fig. 1).—The following papers were presented at the Chicago meeting February 27 to March 2, 1922: President's Address—Resources in Rural Education, by E. Burnham; Some Unsolved Problems of Rural Education from the Viewpoint of Sociology, by E. C. Lindeman; Objectives of Secondary Education, by T. H. Briggs; The Small Community High School, by E. M. Phillips; Problems and Methods in the Organization of Rural Community High Schools, by F. P. Obrien; Consolidated Schools of the Mountains, Valleys, and Plains of Colorado, by C. G. Sargent; Education in Its Proper Environment, by M. E. Sabin; A Rural Teachers' Plattsburg, by A. O. Thomas; The Teachers' Institute as an Agency for Training Teachers in Service, by G. Lommen; A State Program of Instructional Supervision, by J. M. Foote; Training Supervisors for Rural Schools, by W. S. Dakin; The Use of Tests and Measurements in Rural Schools, by L. J. Bennett; Real Supervision for Rural Schools, by J. S. Hoffman; The Curse and Cure of the County Superintendency, by E. B. McDonald; The County Unit of High School Consolidation, by A. F. Harman; The Output of Professional Schools for Teachers That Enter the Rural Service, by C. E. Benson; Junior Extension Work as Developed Through the Public Schools, by W. J. Wright; Junior Extension Work as Developed Through the Public School, by Z. M. Smith; and Some Contributions of the New York Rural School Survey, by J. E. Butterworth.

There are published here also the following papers read at the Boston meeting July 3-7, 1922: The Helping Teacher in New Jersey, by R. A. Fuller; Com-

munity Leagues of Virginia and Their Contribution to Rural Education, by G. W. Guy; The Consolidation of Rural Schools, by L. L. Driver; The Need of High School Opportunity for Country Children, by W. M. Robinson; and The Extent and Control of Rural Child Labor, by C. E. Gibbons.

Relation of the teacher of vocational agriculture to his community, C. V. WILLIAMS (*Vocat. Ed. Mag.*, 1 (1923), No. 6, pp. 412-416, figs. 2).—Certain class projects in vocational agriculture are cited which influenced the agriculture of the community to which the pupils belonged. Cooperation between Smith-Hughes and Smith-Lever workers is urged, also club activity on the part of the vocational agriculture teacher.

In summary it is said that the teacher can keep the work of his department before the community mainly by demonstrations, community meetings carried on by the boys and girls of the high school departments, and items and discussions in the local papers on some problem of farm practice uppermost in the minds of the people of the community.

Some illustrations of effective use of farms and farmers in teaching agriculture, H. M. HAMLIN (*Vocat. Ed. Mag.*, 1 (1923), No. 5, pp. 339-341).—Some typical means of securing community cooperation with the school in teaching agriculture in Iowa and the benefits derived from it are cited.

Teaching cooperation through agricultural organizations, P. C. ROUZER (*Vocat. Ed. Mag.*, 1 (1923), No. 6, pp. 416-419).—Social, economic, and educational activities are outlined for agricultural organizations among the students in secondary schools, and examples are cited of successful cooperative buying and marketing by clubs of boys enrolled in vocational agriculture.

Reaching the adult farmer, R. H. THOMAS (*Vocat. Ed. Mag.*, 1 (1923), No. 5, pp. 343, 344).—Vocational courses for adult farmers in North Carolina are described, and examples are given of some of the results of the work.

The vocational agricultural club, G. S. WILEY (*Vocat. Ed. Mag.*, 1 (1923), No. 5, p. 342).—This describes briefly the rôle of a club composed of boys enrolled in agriculture.

Corn growing in Guam for club members, W. J. GREEN (*Guam Sta. Ext. Circ.* 3 (1923), pp. 11+13, pls. 8, figs. 2).—This circular presents information as to the best cultural methods, storage, seed selection, the preparation of exhibits, and insect pests of corn for club members and others growing this crop on the island of Guam.

A lesson or shop job in overhauling machinery, L. M. ROEHL (*Vocat. Ed. Mag.*, 1 (1923), No. 6, pp. 419-421).—A lesson in overhauling a mower is submitted as an aid to the teachers and boys engaged in this kind of farm shop work.

An industrial arts problem for a one-teacher school, E. VAN SYCKLE (*Jour. Rural Ed.*, 2 (1922), No. 2-3, pp. 118-131).—A plan for arranging around the general problem of the home industrial arts projects for three groups of pupils in a one-teacher school is described in detail.

Food lessons for nutrition classes, M. S. ROSE ([*Columbia Univ.*] *Teachers Col. Bul.*, *Tech. Ed. Bul.* 41 (1922), pp. 26, figs. 11).—The food lessons presented here are designed for children from 8 to 10 years of age, the educational aim of teaching them to eat foods which they do not especially like or do not know being kept uppermost. They are arranged in groups of six lessons to make a progressive series, and are based upon the experience gained in teaching such children.

Equipment for teaching home economics in high schools, J. W. HARRIS (*Vocat. Ed. Mag.*, 1 (1923), No. 6, pp. 442-444).—The unit desk arrangement, the unit kitchen, or a combination of the two having one unit kitchen and 12 unit

desks for classes of about 16 girls are strongly recommended to take the place of the hollow square arrangement of desks with hot plates, inadequate cupboards, and other features unlike the homes where girls will be called upon to carry out in practice their school instruction in home economics.

Improving methods of teaching home economics in continuation schools, E. CONLEY (*Vocat. Ed. Mag.*, 1 (1923), No. 6, pp. 440-442).—Intelligence and educational tests are deemed essential for the proper classification of pupils in the part-time or continuation school. Plans for meeting students in groups and giving instruction suited to the mental capacity of each member are outlined here, as for example, the supervised study, the extra work, the monitorial, and the individual instruction plans. Suggestions are made with reference to lesson planning and unit instruction sheets designed to stimulate independent thought and action on the part of students.

Types of unit instruction sheets for students in home-making classes in part-time and continuation schools (*Vocat. Ed. Mag.*, 1 (1923), No. 7, pp. 521, 522).—Two sheets are given here as prepared by students in a teacher training course at Cornell University in the summer of 1922 under the guidance of the author of the article noted above.

Home-making education in evening schools, A. McARTHUR (*Vocat. Ed. Mag.*, 1 (1923), No. 6, pp. 436-439).—The theme brought forward here is that more emphasis should be placed on the training of girls and women who are ready to put into practice home-making training so that it will definitely help them on their practical jobs as home makers. All home-making classes in the evening school in Duluth, Minn., were definitely organized on the short unit basis in the fall of 1921, and the improvements brought about by the change are set forth here. Such courses must be short, must have a definite aim, must be complete in themselves, the names of the unit courses must carry an appeal, and their content should be the result of a survey of the needs of the group to be taught. A special methods course for evening school teachers was organized also.

The historical pageant in the rural community, A. F. HALSEY (*N. Y. Agr. Col. (Cornell) Ext. Bul.* 54 (1922), pp. 319-342, pgs. 13).—Suggestions are given for writing and producing pageants based upon episodes of local history as well as of general interest.

NOTES.

Kansas College and Station.—Dr. Helen B. Thompson, dean of the division of home economics and professor of food economics and nutrition, has been appointed professor of home economics in the University of California, southern branch, at Los Angeles. A. M. Paterson, professor of sheep husbandry and animal husbandman in sheep investigations, has resigned to engage in commercial work May 10, and will be succeeded July 1 by Harry E. Reed, assistant professor of animal husbandry and assistant animal husbandman at the Arkansas University and Station.

Maryland University.—The exercises of Farmers' Day held May 26 included an address by Governor A. C. Ritchie. A special feature this year was the laying of the cornerstone of the Ritchie Gymnasium and Armory and of the \$100,000 dairy husbandry building.

Michigan College and Station.—The legislature has made special appropriations to the college for the ensuing biennium of \$1,070,000. This is in addition to the receipts from the mill tax, which aggregate about \$1,000,000 and are used entirely for operating expenses. The principal items in the special appropriation are \$400,000 for a horticultural building and greenhouse, \$300,000 for extension work, \$150,000 for a power house, \$50,000 for a college hospital, \$70,000 for research, and \$100,000 for miscellaneous buildings. A loan of \$160,000, payable in ten annual installments, was also authorized to build a stadium seating 16,000 persons and capable of enlargement to 24,000 persons.

The U. S. Department of Agriculture sugar beet station for the humid area has been transferred from Blissfield to the station, under a cooperative arrangement between the Department and the station. F. A. Spragg, plant breeder, E. E. Down, sugar beet specialist, and C. E. Cornumy are to be in charge of the work at the station.

One of the clover stations of the Department is already located at the station. L. W. Kephart, assistant in clover investigations in the Department, has been detailed to work in cooperation with C. R. Megee, forage crops specialist of the station.

The resignation of President David Friday, effective June 1, has been accepted. O. T. Goodwin, associate professor of dairy manufactures and research associate in dairying, resigned May 15 to become manager of the State Milk Producers Association's manufacturing plant at Adrian.

Minnesota University.—N. K. Carnes, assistant professor of animal husbandry, has resigned to accept a commercial position.

Missouri University.—A. C. Burrill has resigned as extension entomologist to become curator of the Missouri Resources Museum Commission.

New York State Station.—Three new red raspberries, seedlings from a cross between June and Cuthbert, have been developed by the station and distributed to members of the State Fruit Testing Cooperative Association, Inc., for further testing. These seedlings have been named Cayuga, Seneca, and Owasco, the first two named being considered the more desirable for commercial purposes.

Porto Rico Insular Station.—Julius Matz, pathologist, has resigned to carry on experiments in agriculture for the Central Porvenir, San Pedro de Macoris, Dominican Republic.

West Virginia University and Station.—J. H. Longwell, assistant professor of animal husbandry and assistant animal husbandman, has resigned to engage in commercial work in California.

Agricultural Education in Canada.—L. H. Newman has been appointed cerealist of the Dominion of Canada vice Dr. Charles E. Saunders, whose resignation has been previously noted. Dr. S. G. Lochhead, professor of bacteriology at the University of Alberta, has been appointed Dominion bacteriologist.

J. P. Sackville, associate professor of animal husbandry in the Ontario Agricultural College, has been appointed head of the department of animal husbandry in the University of Alberta, and has been succeeded by J. C. Steckley. E. Eric Boulden has been appointed professor of agriculture in the Technical and Agricultural School at Charlottetown, P. E. I.

Moscow Regional Experiment Station. A recent report of the Moscow Regional Agricultural Experiment Station gives a brief account of the history and progress of this institution. The station was formally organized in 1912 by the Moscow Zemstvo in cooperation with the zemstvos of the adjoining counties and the Department of Agriculture. The outbreak of the war and subsequent revolution delayed operations, however, so that the construction of new buildings was not begun until 1921. At the close of that year investigations were under way in field crops, animal breeding, vegetable gardening and fruit growing, plant breeding, soils, meteorology, applied botany, entomology, phytopathology, apiculture, and rural economics.

The station is located near Sobakino, about 20 miles from Moscow. Field work is also being carried on in various localities near Moscow on vegetable gardening, fruit growing, and breeding potatoes and other crops suited to sandy soils, and breeding forage plants. A number of farms are used for propagating the improved strains bred at the station.

From 1917 to 1919 the station was in charge of A. I. Stebut. The present director is A. P. Levitzky.

Conference on Agricultural Missions.—A conference of about 50 representatives of the International Association of Agricultural Missions and of about 25 of the American missionary boards and similar organizations engaged in agricultural work through foreign and home missions was held at the U. S. Department of Agriculture, May 5. Representatives of the various bureaus of the Department, the College of Agriculture of Cornell University, and the Canton Christian College and Peking University were among the participants.

The primary purpose of the conference was the stimulation of suggestions as to how agricultural mission schools might encourage research with reference to local or native products and the place of these products in the diet or economic life of the people, and as to the adaptation of agricultural practices, as well as the training of research workers among gifted native students or the staff. The development of mutual exchange relations between such schools and the Department of Agriculture for the introduction of foreign seeds and plants was urged. Representatives of the home missions were particularly interested in procuring results of investigations by the Department into community activities and community organization, also in defining the function of rural ministers in relation to the encouragement and improvement of agriculture.

New Journals.—*Acta Societatis Botanicorum Poloniae* is being published at Warsaw by the Botanical Society of Poland. The initial number contains several original articles in the Polish language with German or French summaries, or in French or Latin. A list of the various institutions, societies, and publications dealing with botany in Poland is appended.

Faserforschung, a journal devoted to the science and technique of the flax plant and fiber industry, is being published by the Sorau Research Institute of the United German Linen Industries. The initial number contains several original articles on flax and other fiber plants.

Archivos de Veterinaria y Zootecnia is being published at Montevideo as the official organ of the Veterinary Medical Society of Uruguay. The initial number contains several original articles, extracts from other journals, notes, etc.

The *Lingnaam Agricultural Review* is being issued semiannually by the College of Agriculture of Canton Christian College, China. This journal will serve as a medium for the publication of the research work of the institution and is also open to others in the Orient engaged in experimental work in agriculture. The initial number contains articles entitled *The Water Buffalo for Dairy Purposes*, by C. O. Levine; *Sericultural Improvement in Southern China*, by C. W. Howard; *A Method of Indexing and Filing Chinese Plants*, by G. W. Groff; *Notes on the Island of Hainan*, by F. A. McClure; *A Preliminary Report of Hookworm Investigations*, by F. Oldt and A. S. Campbell; and *Biology Notes*, by A. S. Campbell, together with brief notes of progress in plant and animal importations, agronomy, sericulture, and farm and laboratory equipment.

Khosiain is an agricultural journal published by the Moscow District Agricultural Experiment Station and intended to supply practical information to farmers. The initial number contains a brief description of the work of the agricultural experiment stations and various short articles.

Publication of the *Country Life Bulletin*, to be issued monthly except during July and August, has been begun by the American Country Life Association. The initial number announces that the next meeting of the association will be held at St. Louis, November 8 to 11, with its general subject the farm home. The bulk of the number consists of brief classified reviews of current books, pamphlets, and articles related to country life.

Miscellaneous.—The London *Times* announces a gift of £10,000 by Sir Walter Buchanan, a pioneer of the frozen meat export industry, for the establishment of a chair of agriculture in Victoria College, Wellington, New Zealand.

The U. S. National Museum has recently secured by purchase, with the cooperation of the U. S. Department of Agriculture, the large private herbarium of Dr. Otto Buchtien, formerly director of the National Museum of Bolivia. This herbarium contains approximately 45,000 specimens, and is particularly rich in species from Bolivia, Chile, Argentina, and Paraguay.

Buildings have now been completed for an agricultural college for the Dominican Republic in connection with the experiment station at Jaina. Instruction in agriculture is also being given in the rural schools, purebred animals are being imported, and some distribution has been made of improved machinery.

Alexander D. Mebane, originator about thirty years ago of the improved strain of cotton bearing his name, died at Lockhart, Tex., April 30.

Dr. Robert L. Pendleton has been appointed professor of soil technology in the College of Agriculture of the University of the Philippines.

ADDITIONAL COPIES
OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.

AT
10 CENTS PER COPY
SUBSCRIPTION PRICE, 75 CENTS PER VOLUME

PURCHASER AGREES NOT TO RESELL OR DISTRIBUTE THIS
COPY FOR PROFIT.—PUB. RES. 87, APPROVED MAY 11, 1922

Indian Agricultural Research Institute (Pusa)
LIBRARY, NEW DELHI-110012

This book can be issued on or before

Return Date	Return Date